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Slow Speed vs. High Speed Balancing

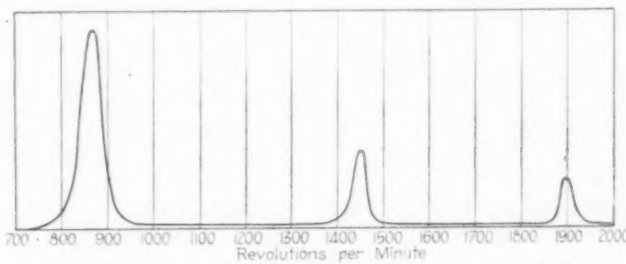
By N. W. AKIMOFF

The problem of balancing crankshafts for automotive uses is being more carefully considered than ever before. Some contend that proper balance can only be secured by running the crankshaft at its maximum speed and that on this account balancing machines are of little value. The conclusions of the author, whose experience is wide, are of special interest at this time.

ONE of the fundamental principles adopted by the writer several years ago, and from which there never was a single occasion to depart, can be put down as follows:

Any rotative body for which slow speed balancing is insufficient or is not conclusive cannot be balanced at all.

By balancing is meant plain correcting for static or dynamic unbalance but not *counterweighting*, which is a different matter. The writer always did and will insist upon the fact that there are two distinct classes or kinds of balance: drafting room balance and shop-balance; in other words balance depending upon design and that due to perfection of manufacture. A body may be in perfect balance from the standpoint of design and yet badly out of balance in actual performance, as for instance a counterweighted shaft, which often will exhibit more vibration due to unbalance than the same shaft would with counterweights taken off but placed in good running balance. As a rule, however, a shaft provided with counterweights and then properly balanced will prove satisfactory from every standpoint. As an example of an arrangement where the design alone is responsible, and where balancing will be of very little help, we might mention a four cylinder or an eight cylinder engine; here neither the counterweights nor most careful balancing will help much, and there will remain a noticeable vibration *at some specific speed*. Now, to revert to the subject of speeds at which to balance, the writer will submit that there are two radically different classes of rotating bodies:



CURVES OF FREQUENCIES AND AMPLITUDES OF VIBRATION

1. Rotating bodies whose shape change with the speed, so that for every speed we have different bodies; and, 2, bodies whose shape is practically speaking, independent of the rotative speed.

Under the first class naturally come such bodies as loosely riveted blowers; weak crankshafts of usual types; armatures of electrical machinery where windings "shift," etc.

Under the second class we might mention: well-made wheels of turbo-blowers, designed for 4,000 r.p.m. and over, well-designed crankshafts of not less than 2¼-in. diameter, preferably counterweighted although not necessarily so; turbine rotors of usual heavy design; armatures of electrical machinery, "baked" in special ovens, or else brought to full speed, preferably under heavy current, prior to balancing.

It is clear, therefore, that a body, whose shape is a function of speed, cannot be balanced or in any way improved by means of any conceivable type of balancing machines; in this case a balancing machine will only indicate faulty design or inferior methods of manufacture, which could just as well be seen from the drawings and specifications. Crankshafts of 2¼-in. diameter or less, the writer submits from several years' practical experience, almost invariably result in failure from standpoint of wear and vibrations; yet, in discussions we often see some one describe a 2-in. or 1¾-in. shaft that was satisfactory; it is safe to say that such never was or could possibly have been the case; 2½ in. is the minimum diameter for short shafts and 2¾ in. for longer shafts of three- and four-bearing type; for seven-bearing shafts 2¾ in., or 2⅞ in., for that matter, is not enough if a satisfactory result is desired from the standpoint of not only smooth running but durability as well. All aviation engines have weak shafts and for this reason balancing, at any speed, becomes a joke; but so is the operation if compared with the faithful performance of an ordinary automobile engine of high or even of medium grade. The reasons or principles, underlying the construction of slender shafts are still weaker than the shafts themselves, and the writer regrets that this subject is somewhat too remote from the one we are considering in the present discussion.

A crankshaft, like any other elastic body can, of course, vibrate in several different ways, both transversely and torsionally, with a considerable variety of periods. However, considering it as a practically rigid body, possessing merely a certain amount of unbalance, we should bear in mind that it is the remainder of the car that constitutes an elastic body, having its several "periods," and the unbalance of the shaft simply acts as an external periodic force, exciting the elastic system to vibrate with the frequency of the former (the shaft). This is the well-known phenomenon of *forced*

vibration, where the frequency of the elastic system does not in any manner depend upon its own physical (elastic) properties but only upon that of excitation.

Now, it is one of the fundamental properties of forced vibrations, that whenever the frequency of the exciting force is equal, or nearly so, to that of any of the free periods of the elastic system, we have *synchronism* with an enormous amplitude, much greater than would appear at first glance, consistent with the magnitude of the exciting agency proper.

A comparatively slight increase of speed—and the condition of synchronism is passed, and the vibration becomes quite negligible. As we increase the speed and approach the next free period (of the system, not of the shaft), the vibration is again increased and reaches its maximum at the exact coincidence of the disturbing frequency with that of the new free period, and again vanishes. As a rule an elastic system has a very great variety of periods, but in practice we are only interested in the first two or three; higher periods would correspond to speeds at which we do not operate our engines. Graphically this state of affairs could be represented as follows: On the axis of speeds are laid off either frequencies or simply the r.p.m. On the axis of ordinates are laid off the amplitudes of the forced vibration of the system (say in fractions of an inch, each way, from the neutral position). The curve will then illustrate the relation between the extent of vibration and the r.p.m. The peaks indicate synchronism. The amplitudes, corresponding to synchronism, should really be infinite, at least in theory. In actual practice, owing to resistances of various kinds, they are not infinite but simply large, considerably greater than under conditions remote from synchronism.

Periods Not Arranged According to Series

It should be well understood that these periods are not ranged according to the series 1:2:3, etc.; so that if there is a vibration at say 850 r.p.m. it does not at all follow that the next "period" will be at 1,700 r.p.m. This is illustrated by the speeds marked on the sketch; the second period may be only 1,450 or so; and the third period may be in the neighborhood of 1,900 r.p.m. All these data are of course meant only for illustration, no two cases being exactly alike, even when the elastic systems look pretty much the same. To predict or figure out these "periods" in advance is much too complicated a problem, and the best we can do is to firmly understand the essence of the problem itself. Now, as soon as the disturbing cause is removed, all excitation stops and the periods disappear. This is what good balance does, in connection with bodies that *are* fit to be balanced. The writer hopes that it is clear that the speed at which to balance does not in any manner enter into this reasoning. But, the reader will object, are not all shafts weak, more or less, under high speed? In other words is not it a fallacy in itself, to consider any shaft to approach the condition of an absolutely rigid body?

By way of answer the writer can only state the following facts from his own experience:

Disregarding the seven-bearing shafts, also the four-throw shafts, in other words confining ourselves to six-throw shafts of three and four-bearing types it is safe to say that these can be (and actually have been) designed to act very nearly like rigid bodies, so that careful balancing is all that is necessary to remove *all periods* (which, as we have just seen, are the periods of the chassis, etc., and not necessarily of the shaft proper).

We are not concerned in this discussion about torsional vibrations, which show up very much like those due to ordinary unbalance. However, the writer finds that if the shaft diameter is not too small and the number of bearings is not over four, the smooth operation, which it is perfectly possible to realize, shows that the torsional "periods" are much too high to give any trouble.

The Writer's Conclusion

The following is the writer's conclusion: If the body is so slender that balancing at low speeds is "not conclusive," it cannot be balanced at all, at any speed. If the body is strong enough, perfect balance can be obtained at low speeds (200 r.p.m., more or less) and remain perfect at high speeds. To balance a body at full operative speed or, as some specifications seem to prescribe, at "overspeeds" of 25 per cent or so, means nothing whatsoever.

Why Johnson Didn't Cut Prices

By John R. Godfrey

About once in so often the preachers tell us about casting bread on the waters and having it come back full of raisins, with nice fresh butter on the side. And once in awhile you find it works out as in Johnson's case.

I've been telling off and on about some of his methods since he fired the gang of high binders who posed as efficiency experts and nearly lost him his "rep" for square dealing and human feelings with his men. But he's been working some other plans that I haven't mentioned because he wanted to try 'em out longer before he sprung them on an unsuspecting public.

But I can't keep it quiet any longer in the face of the way he is winning out in these times when many other motor makers are working short time, are cutting prices or explaining why they don't, and are generally uneasy over the situation.

When Johnson took the reins in his own hands once more he also took his men into his confidence. Not in the patronizing way that always riles a real he-man, but by laying his cards on the table, face up. First of all he considered wages and the increased cost of living. And he boosted wages to meet it without waiting to be asked or threatened. Didn't pick out a few favorites and slip them a $50 bill once in awhile but he looked after them all—that is, all who were worth keeping.

Boosting the Pay Envelope

He called his foremen in one day and said, "Boys we're going to start on a new basis. The old game was to keep a man down to the minimum wage as long as he'll stand for it. The result is the man does just enough to hold his job—and the shop suffers as well as the man. We'll try a new way.

"From now on it's your job to see how much the men in your departments can *earn*—not how little. Don't forget I said *earn*—not get. If experience counts for anything a man ought to be worth more to us the second year than the first—and so on. It's your job to make 'em worth more. The cost of living is going up and we've got to meet that—and more. Whenever your men are worth more to the company let me know at

once—don't wait to be asked for a raise. If they are not worth more there's a reason, and you're the goat. They are either on the wrong job or you haven't handled 'em right. We want them to be worth more. And the more you make them worth to us the more valuable you are to us yourself—in dollars and cents, not in flowery language which the grocer won't take at a discount."

Wages Doubled—Production Doubled

To make this part of the story short, wages have gone up over 100 per cent in Johnson's shop as they have in many others—but—and here's where Johnson's fine handiwork shows up—production per man has just about kept pace with wages! Labor costs per piece are no higher than before. And Johnson motor prices only advanced 10 per cent, while his competitors who thought he was crazy boosted theirs 10 per cent every new moon until they got all the traffic would bear.

They got more, too. They made every customer sore and the bread they cast on the water hasn't come back with raisins—most of it got waterlogged and went to the bottom. Now they are trying to cut prices without admitting they were too high before. But they can't touch Johnson's price because their production costs are away above his, so he is busy while they are flirting with receivers and bankruptcy.

I asked Johnson to tell me how he did it and, in a more or less rambling way, this is the way he told it.

"You see, Godfrey, that jolt I got when those two bugs made the men think I'd grown horns instead of wings set me to thinking and I decided to try playing the cards face up. The more men know and understand the better work they can and will do. So I started in to see that they knew what was going on. I posted figures from our books for several years back, showed what part wages and material played in total costs and how these costs could be lowered.

"We told the men, through their foremen, the value of the different machines, what an hour's delay meant in dollars and cents, and in decreasing output. When we put in new machines we told them what they cost and what they could do—also what they *must* do to be profitable. We posted the cost of material and what it meant to spoil a piece at various stages of its progress, this including labor already performed.

"Then we did the wholly unorthodox thing of posting both cost and selling price, including overhead of course, and this meant showing the profit on each engine or each lot of engines. And, just to go the whole figure, we told 'em just how much profit we divided and who got it, and how much we put back into the business in the way of new tools and equipment. We've limited our profits to 8 per cent, same as the White Co., and the men know it and what's more they *believe* it. When we can earn more than this after putting what we need into equipment, we'll see about reducing prices, not before.

"You see, Godfrey, men will come across when you play the game squarely with them. There isn't any bonus or any profit sharing and no promise of any. But they know we don't play hog at profits and they know our prices mean keeping busy long after the other fellows are shut down.

"They told me I couldn't get production without elaborate piece work or bonus systems, but it's all day work and not even a bonus. And it's all because we've never broken faith with 'em once. If we ever do — the jig is up. You can't get production like ours unless the men know you're square and they feel like part of the family. You can't get a man to work very hard when he knows or suspects that you are making an exorbitant profit. He may be getting big money but it seems small beside some of the war profits that have been made and he has no ambition or incentive to really see what he can do. When he *knows* he's getting his share or that you are not getting more than your share, he'll dig in and play the game just as you or I would.

"Human nature is about the same whether it's in the office or the shop. But we mustn't forget to make more allowances for lapses on the part of the men because of their lack of vision and education. Those of us who are managing businesses should have a broader viewpoint than the average men in the shop. The community and the world have a right to expect and to demand more of us than of the men. And the low-down manager who tries trickery and wants to have hard times so he can get even with his men, is a disgrace to the human family. I'd like to help ride him on a rail myself. He's the chap who will get us into trouble—if trouble comes as I sure hope it won't."

Johnson Gets the Pick of Good Men

Do you wonder that Johnson has his men with him—that they give him the best they've got—that they'd fight for him at the drop of the hat? He gets the pick of the men in our town and he has the respect of everybody but the old-time managers. He won't ever be a millionaire—but he's worth more to the country than many of those who are.

Correction

A serious error appeared in the article on making micrometers on page 605 of the September 30th issue.

In this article we stated that the spindle and screw were made of one solid piece of tool steel. The accompanying illustration shows that the spindle and screw are separate pieces and NOT *one piece of tool steel, the screw being drilled out at one end and forced or shrunk on to the spindle as shown.*

We are sorry that this misstatement occurred and are glad to make this correction in justice to the J. T. Slocomb Company, who manufacture the only micrometer having the spindle and screw of one solid piece of tool steel.

THE UPPER VIEW SHOWS THE PARTS OF THE TWO-PIECE SPINDLE SLIGHTLY SEPARATED. THE LOWER VIEW SHOWS THE PARTS ALMOST PULLED OUT

The Law of Coriolis

By HENRY N. BONIS, B.S., M.E.
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Under this somewhat forbidding title the author gives in detail a simplified solution of the problem of determining the acceleration of a point on a flyweight link without the use of the fictitious acceleration of Coriolis. He uses the parallelogram law for velocity and acceleration and proves the correctness of his method by superimposing the theorem of Coriolis solution upon his own.

THE writer wishes to call attention to a misconception usually found in books on Kinematics, for example, on page 149—A. W. Klein, "Kinematics of Machinery"—the following statement is made, in reference to finding the acceleration of a point on the flyweight link of a governor, "But this parallelogram of motions will not in the same sense suffice for the determination of the resultant acceleration of point F," and then proceeds to bring in the supplementary component acceleration $2V_r w_1$ of Coriolis in order to solve the problem. It would appear from the above to the reader that the parallelogram law had an exceptional case in the determination of accelerations, which, however, is not so, as the following article will show that if the proper components are taken, whether for velocities or for accelerations, the resultant in both cases can be obtained by adding two vectors, one vector representing the relative relation of the given point to a point of reference, and the second vector the relative relation of the point of reference to fixed space.

Though in the case of velocities the two components chosen in Prof. Klein's book give the correct resultant velocity, it is because these components are the result of an investigation based on the parallelogram law applied to rotations about two parallel axes, and hence their use gives a correct result.

As far as determining the acceleration of a point on the flyweight link, the following article will show that the Law of Coriolis is not necessary to the solution; that the parallelogram law of accelerations holds, and affords a simpler proof than the one given (which I believe is identical with Dr. Burmeister's in "Lehrbuch der Kinematik") of the fictitious acceleration of Coriolis. It is to be understood by the reader that in dynamical problems it is very often convenient to use axes which themselves move in space and to which the motions of the body under consideration are referred, and the theorem of Coriolis gives us a rule that we may consider the moving axes to be at rest if to the *actual* forces applied to the body fictitious ones be added capable of producing accelerations equal and opposite to the acceleration of moving space and to the compound centripetal acceleration. (See "Routh's Elementary Rigid Dynamics," 1882, page 183, Example 213.)

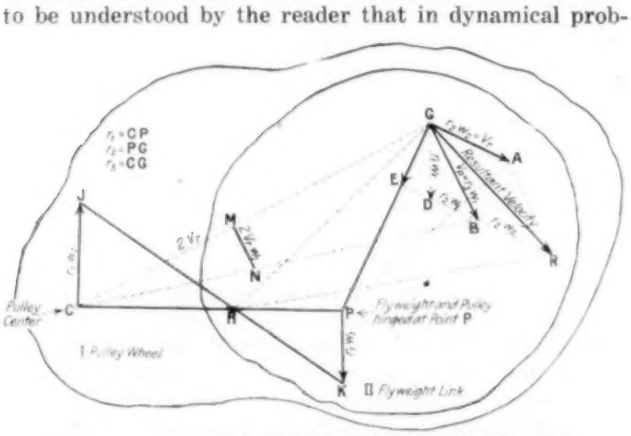


FIG. 1. VELOCITY DIAGRAM FOR PULLEY AND FLYWEIGHT

Velocity Determination

Referring to Fig. 1 we are given the angular velocity w_1 and angular acceleration $Dw_1 = (dw/dt)_1$ of the pulley wheel I about its shaft center C, and the relative angular velocity w_2 and relative angular acceleration $Dw_2 = (dw/dt)_2$ of the flyweight link II with respect to the pulley. The flyweight link and pulley link are hinged together at P (see Prof. A. W. Klein, "Kinematics of Machinery," Chapter X, page 148) or Fig. 2.

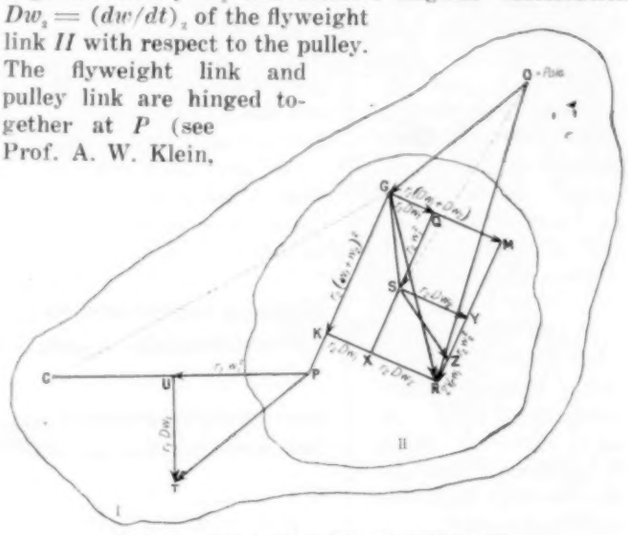


FIG. 2. PULLEY WITH FLYWEIGHT

Symbols.

$r_1 = CP$

$r_2 = PG$

$r_3 = CG$ = distance from shaft center C to point G on pulley directly under G on flyweight.

$V_r = r_2 w_2 = GA$ velocity of flyweight point G relative to plane of pulley I.

$V_P = r_3 w_1 = GB$ = velocity of point G on pulley I about C.

In order to find the resultant absolute velocity of point G on flyweight, the usual procedure is to combine the two components V_r and V_p into the resultant velocity GR.

From another point of view if we consider the line CP in the plane of II we will note that as the motion of plane II consists of rotations about parallel axes P and C the point C of line CP has only the velocity $CJ = r_1 w_2$ perpendicular to the line CP about center P and the point P has only a velocity $PK = r_1 w_1$ about center C, we can easily determine the instantaneous center of the line CP (and hence of the plane II) by

joining the ends J and K of these normal velocity vectors, by the line JK, and the intersection of JK and CP is the instantaneous center H. The velocity of G can now be determined by making the angle $GHR = PHK$ or CHJ and drawing GR perpendicular to HG.

The instantaneous center H could also be found by the rule of composition of angular velocity about parallel axes by dividing the line CP inversely as the angular velocities w_1 and w_2 which is evident from the construction as triangles HPK and HCJ are similar, thus

$$\frac{HP}{HC} = \frac{PK}{CJ} = \frac{r_1 w_1}{r_1 w_2} = \frac{w_1}{w_2} \qquad (1)$$

Again the angular velocity of any point in Plane II about the instantaneous center H is $(w_1 + w_2)$ as proven thus

$$\text{angular velocity} = \frac{PK}{HP} = \frac{r_1 w_1}{HP}$$

But from equation (1) we have by composition

$$\frac{HP}{HC + HP} = \frac{HP}{r_1} = \frac{w_1}{w_1 + w_2}.$$

$$\text{Therefore angular velocity} = \frac{r_1 w_1}{r_1 \frac{w_1}{w_1 + w_2}} = w_1 + w_2$$

We have thus proved that the plane II or any line in plane II as GP is rotating in fixed space with an angular velocity $w_1 + w_2$; but this fact is self-evident, because if the line PG on flyweight has no motion relative to line PG on pulley its angular velocity would have been w_1 the same as any line on plane I, but as PG on plane II has an angular velocity relative to PG on plane I its angular velocity in fixed space is evidently the algebraic sum of $w_1 + w_2$. Now if the line PG is rotating in fixed space with angular velocity $(w_1 + w_2)$ *the relative velocity of point* G to point P is $r_2(w_1 + w_2)$ perpendicular to the line PG, and since we know the absolute velocity of point P, that is PK, we can get the resultant velocity of G by the vector sum of $PK = GD = r_1 w_1$ and $DR = r_2(w_1 + w_2)$ drawn perpendicular to line PG.

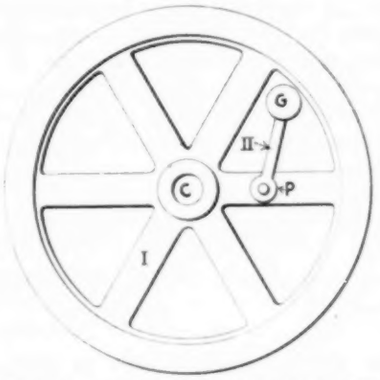


FIG. 3. ACCELERATION DIAGRAM FOR PULLEY FLYWEIGHT

It is well for the reader to note that the components GE of the velocities GD and GR along the line GP are identical, otherwise the points G and P would change their distance from each other, and furthermore the fact that the relative velocity of G to P can only be perpendicular to PG, since P acts as a center about which G is rotating.

Superimposing both velocity diagrams, and comparing the triangle GDB with triangle CPG on the pulley-wheel, we find that these triangles are similar, having their sides respectively perpendicular, and hence using G as a pole the triangle GDB is a triangle of velocities, for the points C, P, G on pulley wheel, the ratio of the sides being $w_1 : 1$ as it should be, since the triangle CPG on pulley is moving as a whole about the shaft center C. Hence $DB = r_2 w_1$ (which is the relative velocity of point G on pulley about P). But since $DR = r_2(w_1 + w_2)$ we have $BR = r_2 w_2 = V_P$. We also have from the above similar triangles $GB = r_2 w_1 = V_P$, and hence we see that the use of these components V_G and V_P gives us the same resultant velocity GR as GD and DR.

Total Absolute Acceleration

In order to find the total absolute acceleration of point G on flyweight we proceed in a similar way; namely, find the relative acceleration of point G to P and then add to this relative acceleration, the absolute acceleration of point P. The angular velocity of the line PG of the flyweight in fixed space is $(w_1 + w_2)$ and therefore the relative centripetal acceleration of G about P is $r_2(w_1 + w_2)^2$ which is laid off to scale equal to GK—from G to K. (See Fig. 3.) Similarly the angular acceleration of the line PG in fixed space is $(Dw_1 + Dw_2)$ and hence the relative tangential acceleration of G about P is $r_2(Dw_1 + Dw_2)$ which is laid off to scale equal to GM. Combining these two components into a resultant GR we have the total acceleration of point G relative to point P. Again since P is a point on the pulley, we know its absolute acceleration PT (since centripetal acceleration $PU = r_1 w_1^2$ and tangential acceleration $UT = r_1 Dw_1$ both about C are known), and hence if we add the acceleration vector $OG = PT$ to the relative acceleration GR, we get the total absolute resultant acceleration OR of the point G in fixed space.

Method Employed by Using Theorem of Coriolis

The method employed by using the theorem of Coriolis in the determination of the total absolute resultant acceleration of point G is to add together geometrically the three following acceleration vectors. (1) The total acceleration of point G on the pulley about its center C. (2) The total acceleration of point G on flyweight about its center P. (3) The fictitious acceleration of Coriolis $2 V_r w_1$ at right angles to the velocity vector V_r. In order to show the relationship of both solutions it will be necessary to superimpose both methods. Thus—Draw OS equal to the acceleration of point G on pulley. Draw SZ equal to the acceleration of point G on flyweight about P. Draw ZR at right angles to GM equal to $2 V_r w_1$ and we get OR as the total absolute resultant acceleration of point G on flyweight.

In order to prove that the points R of both methods coincide we will analyze our composite acceleration diagram. In triangle OGS we have OG, OS, and point O representing the accelerations of the points P, G, and C respectively of the triangle PGC on the pulley. (This acceleration triangle is termed the image of the original configuration PGC.) Hence GS represents the relative acceleration of point G on pulley about P. Draw XSQ through S parallel to PG and SY perpendicular to PG. The relative acceleration of point G on pulley about P is composed of the relative tangential component $GQ = r_2 Dw_1 = KX$ and the relative centripetal component $QS = r_2 w_1^2 = MY$. Again SZ is the acceleration of point G on flyweight about P and is composed of the tangential acceleration component $SY = r_2 Dw_2 = XR$ and centripetal acceleration component $YZ = r_2 w_2^2$. Now $GQ + SY = r_2 Dw_1 + r_2 Dw_2 = KR = GM$. Hence point Z falls on MR, also $MZ = MY + YZ = r_2 w_1^2 + r_2 w_2^2$. But $ZR = MR - MZ = GK - MZ = r_2 (w_1 + w_2)^2 -$

$(r_2w_1^2 + r_2w_2^2) = 2r_2w_1w_2$. Hence $ZR = 2V_rw_1$ since $V_r = r_2w_2$ which is the acceleration of Coriolis and hence both points R coincide. *Q.E.D.*

It is evident from the above solution that I furnish a very simple proof of the Law of Coriolis.

In the execution of the problem it is not necessary to calculate $2V_rw_1$ as it can be obtained graphically by laying off CM in Fig. 1 on the line CG equal to $2V_r$ and drawing MN perpendicular to CG and limiting N by the line CB. MN is then equal to $2V_rw_1$. This is evident since triangles BGC and NMC are similar and

$$\frac{MN}{MC} = \frac{GB}{GC} \text{ or } MN = MC\,\frac{GB}{GC} = 2V_r\,\frac{r_2w_1}{r_2} = 2V_rw_1.$$

As regards the direction of $2V_rw_1$, it is evident from the figure that if w_1 and w_2 are of opposite signs, the point R would fall between M and Z, because $MZ = MY + YZ = r_2w_1^2 + r_2w_2^2$ and $MR = GK$ would equal $r_2(-w_1 - w_2)^2 = r_2w_1^2 - 2r_2w_1w_2 + r_2w_2^2$ and therefore MZ would be greater than MR. Hence $2V_rw_1 = ZR$ would have to be laid off in the direction of P to G. This statement is in accord with the one given in "Kinematics of Machinery," page 156.

Looking back at the foregoing proof it may be said that the point P was chosen as the point of reference and the relative velocity or acceleration of point G on flyweight to point P has been combined with the relative velocity or acceleration of P to fixed space, and two vectors have been obtained in either case to give the resultant velocity or acceleration. Thus in Fig. 1, in the case of velocity, we have DR and GD as the components of the resultant velocity GR, and in Fig. 2, in the case of accelerations we have GR and OG as the components of the resultant acceleration OR. But the point of reference is entirely arbitrary and the same result will be obtained if the relative velocity or acceleration of point G on flyweight with respect to any point of reference is combined with the absolute velocity or acceleration of this point of reference. Thus if we choose the point G on the pulley as the point of reference, we must determine the relative velocity or acceleration of point G on flyweight to point G on pulley, and combine this with the absolute velocity or acceleration of point G on pulley.

Now the relative velocity of G on flyweight to G on pulley is the vector sum of the relative velocity of G on flyweight to point P and the relative velocity of point P to point G on pulley. But the relative velocity of G on flyweight to P is $r_2(w_1 + w_2)$ perpendicular to PG, and the relative velocity of P to point G on pulley is $-r_2w_1$ (that is equal to and opposite to the velocity of G on pulley to P) also perpendicular to PG. Hence the relative velocity of point G on flyweight to point G on pulley is $r_2(w_1 + w_2) - r_2w_1 = r_2w_2 = V_r$ perpendicular to PG; and therefore combining V_r with the velocity of G on pulley, $V_P = r_2w_1$, will give the same resultant velocity GR.

To determine the relative acceleration of point G on flyweight to point G on pulley, we proceed in a similar manner. Thus the relative acceleration of G on flyweight to G on pulley is equal to the vector sum of the relative acceleration of G on flyweight to P, and the relative acceleration of P to G on pulley. But the relative acceleration of G on flyweight to P (see Fig. 3) is GR, and the relative acceleration of P to G on pulley is $SG = -GS$ (since acceleration of P to G on pulley is equal and opposite to acceleration of G on pulley to P) and hence the relative acceleration of G on flyweight to G on pulley is the vector sum $GR + SG = GR - GS = SR$ (not drawn in Fig. 3). Hence the total acceleration of G on flyweight is obtained by combining the acceleration SR with the acceleration OS of the point G on pulley to obtain the same resultant acceleration OR.

It is to be noted that the theorem of Coriolis shows that this relative acceleration SR is the vector sum of SZ and ZR and hence in the determination of the total acceleration of point G on flyweight we can use three vectors, for the law of Coriolis does not claim that the parallelogram of accelerations has an exceptional case and does not always hold. In fact, in the case of velocities, when point G on pulley was assumed as the point of reference we have three vectors, $r_2(w_1w_2)$, $-r_2w_1$, and r_2w_1, but as the first two are parallel and can be added algebraically we have actually only two to work with, r_2w_2 and r_2w_1. The confusion therefore arises from the assumption of the point of reference. If, as has been done, the point P is chosen as the point of reference only two vectors are necessary, a much simpler solution is obtained and the law of Coriolis does not have to be utilized.

Conclusion

In conclusion the writer desires to state that the solution of most problems in Kinematics of Machinery can be solved by the proper use of fundamental concepts and principles, and that it is better psychologically for the student and practically for the engineer to understand the fundamentals thoroughly than to use a complex formula which may be misapplied.

Improvised Extension for Small Twist Drills

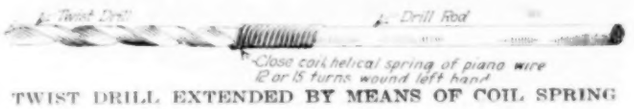
By J. C. Nicholson

Here is a quick way to improvise an extension for a twist drill.

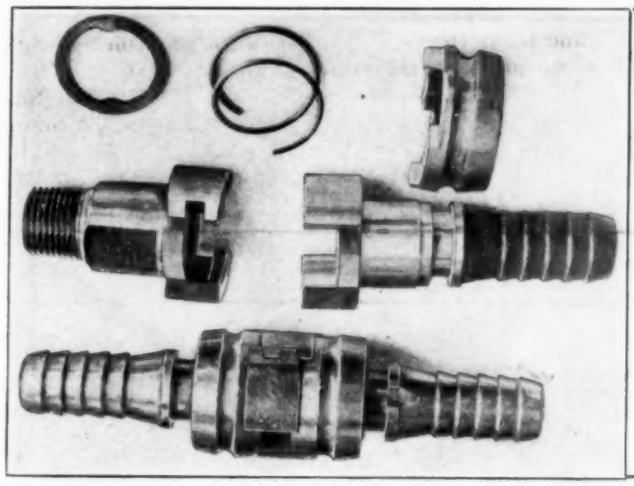
Wind a left-hand closed coil helical spring out of piano wire of about one-third or one-fourth the diameter of the drill and use this as a coupling to connect the drill with a piece of drill rod or other stock of about the same diameter. There should be about a dozen coils in the spring and the inside diameter should be slightly smaller than the drill and extension piece to allow them to be driven into it. The ends of drill and drill rod should be ground square with the axis where they abut.

The torsional stress on the spring causes it to grip the drill and extension firmly. The drill may readily be driven out of the spring by means of the extension. One spring will serve for drills varying several thousandths in diameter.

It may not be known to some that such a spring may easily be made in the vise with a monkey wrench. Grip the arbor and wire in the vise together and make one coil by hand. Then close the monkey wrench to the outside diameter of the spring and use it to bend the wire around the arbor to a uniform diameter.



TWIST DRILL EXTENDED BY MEANS OF COIL SPRING



Making Thor Quick-Action Air Line Couplers

By J. V. HUNTER
Western Editor, *American Machinist*

The couplers for air-hose lines must be carefully made to insure the same degree of air-tightness that is found on high-grade valves and other fittings, and yet their design must be such that a tight coupling can be made very quickly. This article describes the main machining operations used in producing couplers in large quantities.

THE day seems to be rapidly passing in which the boss riveter has to send his helper to look around among a mess of plumber's fittings to find a couple of small pipe-nipples and couplings that can be used for attaching the air hose to the line or for joining a couple of sections. Today different makes of quick-action couplers have gained popularity since their use has shown that they afford a uniform quick connection with the additional advantage of lesser air leakage than frequently occurs with poorly fitting pipe connections.

The Independent Pneumatic Tool Co., Chicago, has equipped a complete department in its Aurora factory for the manufacture of the Thor quick-action coupler. Numerous special tools and devices are used to speed the production of these parts and to insure accuracy. A completed hose coupling together with the different metal parts that go to make up its assembly are shown in Fig. 1.

The more interesting machining operations are found in connection with the production of the main body pieces which are made in two styles, either for insertion in an air hose or with a threaded end for attaching to a standard pipe connection. With the exception of few screw machine operations to finish the connection ends, their manufacture is identical. The "connection end" is that portion which attaches to the hose or pipe, and the "coupling end" refers to that portion which joins the other section of a coupler.

The first screw-machine set-up for finishing a hose connection end is shown in Fig. 2. Standard tools and an air-operated chuck are used. This operation is followed by the screw machine operations on the coupling end, Fig. 3, with the work centered in a collet chuck.

Following the screw machine operations is a straddle milling operation, on the pipe connectors only, which gives two parallel faces for the application of a wrench.

The form milling cutter used in the next operation, Fig. 4, is applied to both styles of connectors and removes approximately a quarter section of the larger end. The same milling fixture is employed for both pipe and hose connectors and when milling the former, the special block *A* is inserted. After milling one side the holding block *B* is depressed by means of the small lever *C*, permitting the piece to be turned with the other side up. For the second cut the spacing block fits into the section already milled away and locates the piece in the position shown.

The locking feature for holding the two halves of the coupler together is provided by milling the small notches *A*, Fig. 5. This milling operation is performed on a hand milling machine and the fixture employed is somewhat similar to the one previously described. The spacing block *B* aligns successively the two sectional cuts as these are turned up for cutting the notches. The connection end of the coupler passes through the fixture and is locked in place by a quick-acting clamp operated by handle *C*.

Two small grooves *A*, Fig. 6, milled in the sides of the main body piece, serve as keyways to guide the locking sleeve. To perform this operation an old screw

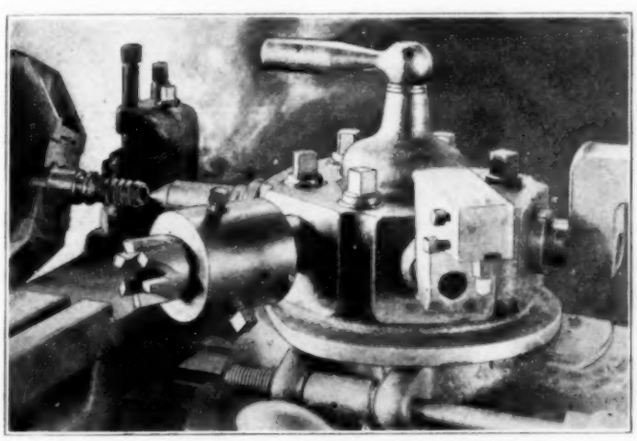


FIG. 2. FIRST SCREW MACHINE OPERATION ON CONNECTION ENDS

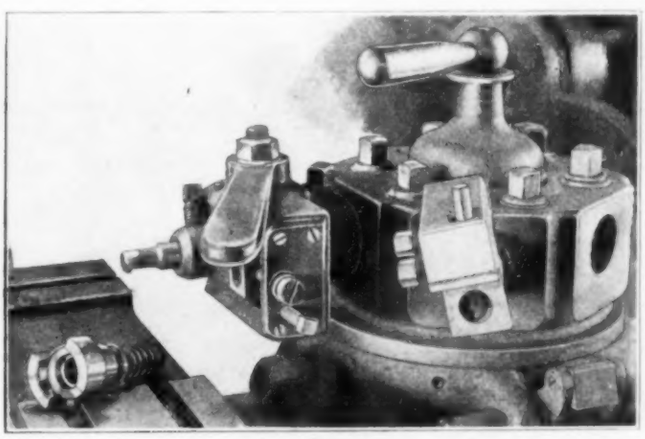


FIG. 3. SCREW MACHINE TOOLING FOR FINISHING COUPLER ENDS

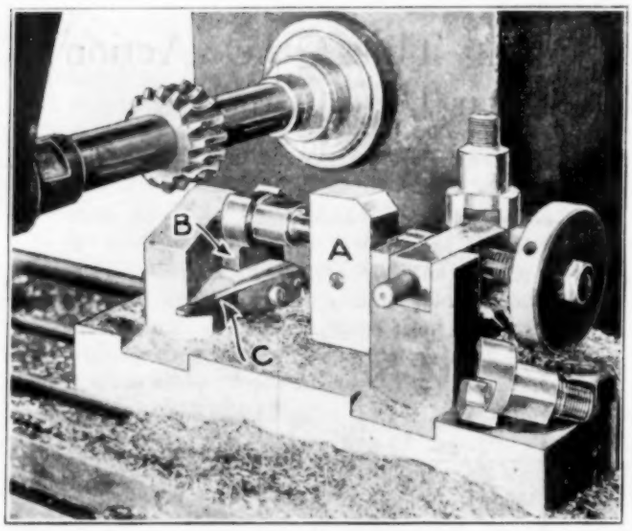


FIG. 4. FORM MILLING OPERATION ON CONNECTORS

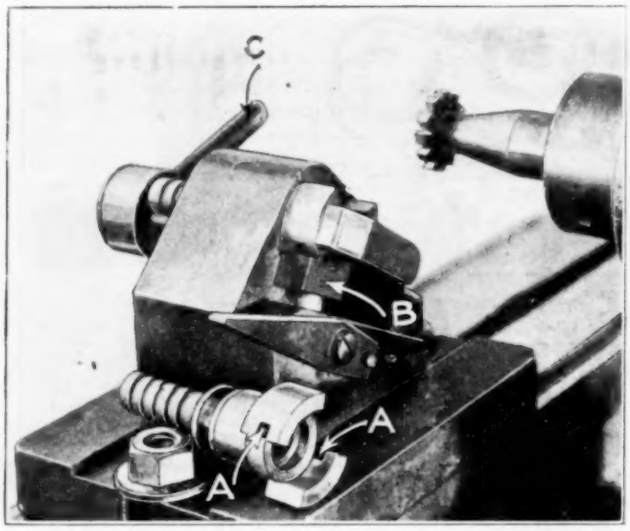


FIG. 5. MILLING LOCKING NOTCHES IN COUPLING END

machine has been rebuilt and fitted with a spindle head mounted on the toolslide and carrying two small milling cutters B. When the toolslide and spindle are brought forward by the hand lever the sleeve *C* passes over the connection end of the coupler and the cutters mill the grooves as shown. The forward motion of the toolslide is arrested when the sleeve comes in contact with the large portion of the coupler.

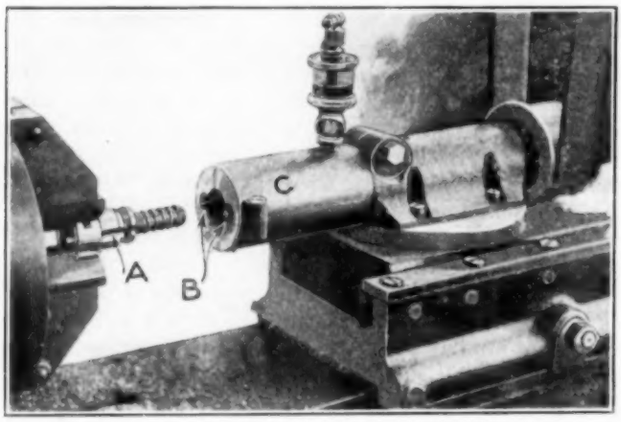


FIG. 6. MILLING GUIDE GROOVES FOR LOCKING SLEEVE

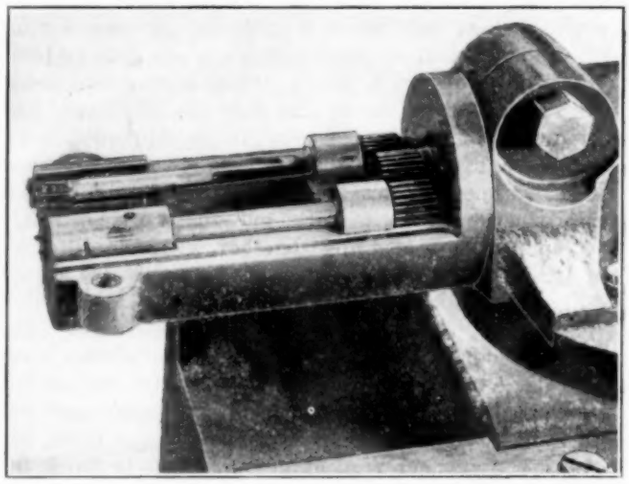


FIG. 7. INTERIOR OF SPECIAL MILLING DEVICE

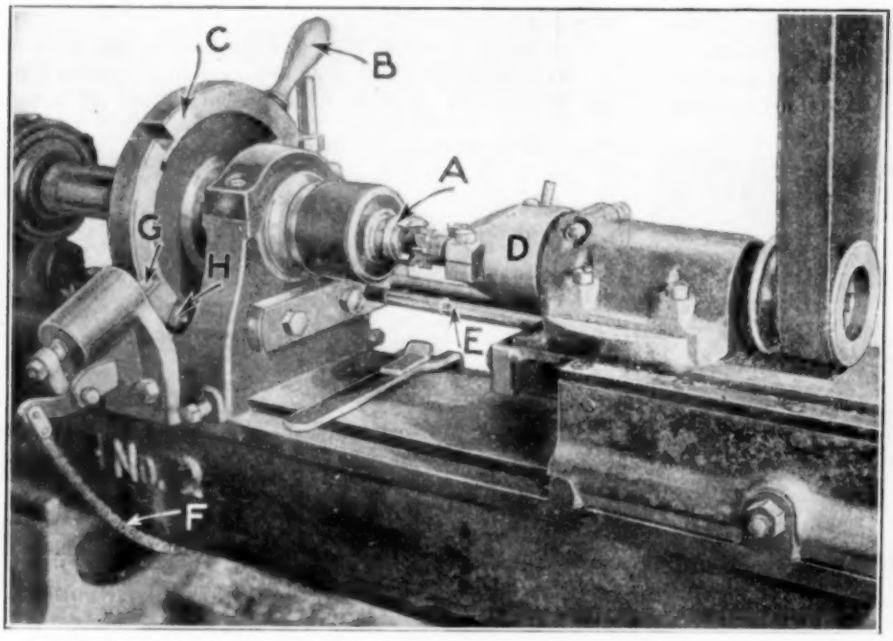


FIG. 8. DEVICE FOR MILLING ENDS OF LOCKING SLEEVES

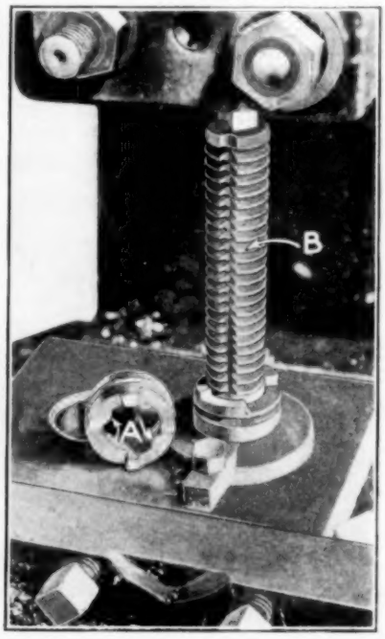


FIG. 9. BROACHING OF LOCKING SLEEVES

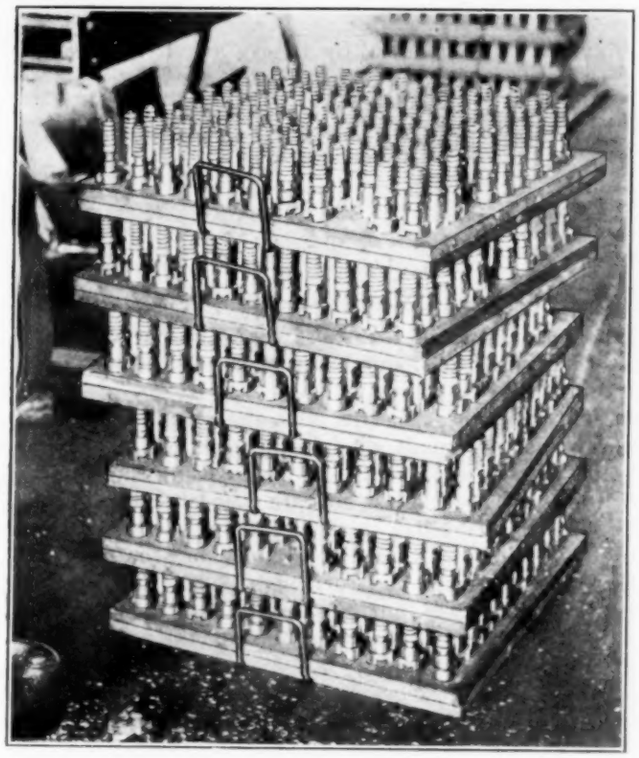


FIG. 10. TRAYS FOR TRANSPORTING FINISHED PARTS

The internal construction of this device is shown in Fig. 7. The main spindle is driven by a belt from the countershaft, and in turn drives the two cutter spindles through the gears shown. The operation is performed very rapidly and is expedited by an air chuck for holding the work.

The first operation on the coupler locking sleeve, shown at the lower left of Fig. 1, is on a screw machine. The sections on the right-hand end are then milled off.

A two-spindle milling device, Fig. 8, built for this job, is somewhat similar to the milling device previously described. The work *A* is held in a pneumatic collet chuck which can be rotated by the handle *B* for indexing by the notched dial *C*. The double-spindle head *D*, provided to carry the two cutters, is mounted on the toolslide so that it may be fed forward and back by the hand lever. This forward feed motion is continued until the cutters cut the deep notches in one section of the sleeve, when the feed is arrested by the stationary stop-bar *E*. After cutting the pair of deep notches the toolslide at the end of its return stroke, through suitable connections, draws down on the chain *F* which pulls out the stop-pin *G* and permits the index plate to be rotated, bringing the sleeve in line with the cutters for the shallow cut. The stop-pin falls into the proper notch to hold the index plate when the tension is removed from the chain by the forward movement of the slide. The second cut is to only one-half the depth of the first and this is controlled in the following manner: In rotating the indexing dial an additional stop-plate *H* riveted to its face, is swung over in line with the stop-bar *E* and the forward motion of the slide is thus arrested at the proper point.

The final operaion on the locking sleeve is broaching, to leave the half-round keys on the inside as seen in Fig. 9. This operation is performed in a vertical broaching press.

In connection with the work in this department it is interesting to note the means provided for the transportation of the finished parts in order to avoid the danger of their sharp edges being marred or burred before they are encased in the sleeves which protect them from injury. Special trays, Fig. 10, are used, made with wooden dowel-pins which support the parts in an upright position. Each tray holds an even 100 pieces. Iron handles are provided and the loaded trays are not so heavy but that they are easily handled by two helpers.

Labor Turnover in New York City*

Accurate figures on classified labor turnover are always interesting even though they apply only to a restricted locality. These figures for New York City appeared in "Greater New York," the weekly publication of the Merchants' Association of New York. They are well worth studying.

THE average yearly rate of labor shift or "turnover," in 1920 for skilled and semi-skilled factory workers in New York City is 125 per cent, and for unskilled factory workers 265 per cent, according to reports made to the Industrial Bureau of The Merchants' Association by 42 manufacturing concerns representing 15 different industries and employing a total average force of 41,375 workers.

In about two thirds of the plants studied the turnover lay between 100 and 250 per cent, but the total range for all plants extended from a minimum of 16⅔ per cent to a maximum of 338 per cent.

The cost of replacements, according to the testimony of employers, varies from $10 for unskilled to $250 for highly skilled workers. A fair average for semi-skilled employees is $50 or more.

The industries covered in this study and the number of plants in each industry are as follows: Metal products, including machinery, ten; food products, confectionery and kindred lines, eleven; rubber goods, three; musical instruments, three; printing, two; jewelry and kindred lines, two; tobacco products and smokers' supplies, two; stationery supplies, two; and one each of shipbuilding and repairing, marine equipment, shoes, silk goods, men's clothing, women's wear, and fire apparatus.

Food and Metal Products

Special attention was devoted to the food and metal products industries, in order to secure comparative figures for an industry employing principally unskilled labor, as is the case in food products plants, and for one chiefly dependent upon skilled labor, such as the metal industry. The food products industry, using largely unskilled labor, also employs a large proportion of female workers. At first sight, it might seem that

*Prepared by the Industrial Bureau of the Merchants' Association of New York City.

this fact would tend to a somewhat higher labor turnover in this industry than in one employing a majority of unskilled male laborers; but when it is considered that untrained male workers are of a particularly transient character, and are employed so largely in construction work and other seasonal industries, where turnover is especially large, the figures for unskilled female workers are probably not higher than those for unskilled male workers and are therefore fairly representative of the class.

With some exceptions, the period investigated was the first eight months of 1920. In certain trades, especially those of a seasonal character, the figures for the last twelve months were covered. In all cases the percentage of turnover has been computed on an annual basis.

Pre-War Figures Unavailable

In compiling this report an effort was made to secure pre-war figures for comparative purposes. This was found impossible, however, because the figures are not available. It is only within the last few years that employers generally have come to realize the importance of accurate employment records, and even for the purposes of the present study it was necessary to reject 35 per cent of the reports received as not sufficiently complete or accurate to warrant their use as a basis for conclusions. Incidentally, it is probable that the turnover in the factories covered by this study is smaller than in many other local establishments which could not be included because they did not keep records, and otherwise paid little or no attention to employment methods. Fragmentary data obtained while making the study supports this conclusion.

Stability Increasing

It is the general opinion of employers that the turnover of factory labor has increased greatly during the past few years, especially during the war period and for some time after the signing of the Armistice. The tendency now, however, seems to be in the opposite direction. Labor turnover at the present time is on the decrease. This is doubtless due to a certain extent to the increasing activity on the part of employers to reduce turnover, but principally to the appearance of some unemployment, a condition which always makes the worker hesitant about changing his place of employment.

To most people, labor turnover is equivalent to labor replacement and is generally expressed in the form of percentages.

For the purpose of this report, therefore, labor turnover has been computed by diving the number of employees replaced during a year by the average number of persons on the payroll during the same period. For example, if there was an average of 100 men on the payroll of a concern during the year, and 200 additional employees had to be secured during that time to replace those who were fired, died, or quit for any other cause, the turnover would be twice the average number on the payroll, or 200 per cent. In a decreasing payroll, replacements will equal the number of people hired, while in an increasing one they will equal the number of separations from the plant.

The accompanying table summarizes the results of the investigation.

The above summary shows that slightly more than one-fifth of the plants had a turnover below 100 per cent a year, half of them less than 150 per cent, and one-third had an annual turnover of 200 per cent or more.

PRESENT ANNUAL RATE OF LABOR TURNOVER IN 42 MANUFACTURING PLANTS IN NEW YORK CITY

Classified turnover (Percentage)	Plants in Each Class Number	Percentage
Under 50	4	9.5
50 and under 100	5	11.9
100 and under 150	12	28.6
150 and under 200	7	16.7
200 and under 250	8	19.1
250 and under 300	3	7.1
300 and under 350	3	7.1
	42	100.0

Comparing these figures with the results of a labor turnover study made during the war by the United States Bureau of Labor Statistics, covering thirty-seven factories in Cleveland, it appears that labor turnover in New York City today is considerably less than it was in Cleveland two years ago. Only one-tenth of the Cleveland factories had turnovers under 100 per cent, approximately one-fourth of less than 150 per cent, while more than three-fifths had annual replacements of 200 per cent or more.

It is true that the labor conditions in Cleveland during the war were not exactly comparable with those in New York during the same period, but the comparison supports the statement of the majority of the manufacturers interviewed that on the whole there has been a reduction in labor turnover since the signing of the Armistice.

The above table also indicates a very broad range of turnover. In about two-thirds of the plants it varied from 100 to 250 per cent. The reason for this wide divergence is due primarily to the heterogeneous nature of the plants covered. This becomes clear if the forty-two plants be divided into two groups: (1) those employing primarily unskilled help, and (2) those using mainly semi-skilled and skilled operatives.

Skilled and Unskilled Labor

Obviously, it is impossible to draw any hard and fast line between these two groups. Many plants employ all grades of workers, from the totally unskilled to the highest grade mechanics. Nevertheless, it is possible roughly to group factories into these two classifications. The unskilled group includes all establishments in which the majority of operatives require little or no training for their jobs. As a rule, these establishments, at least in New York City, employ a large proportion of female labor. Most food products plants, candy concerns and the like, would fall under this head. All other factories come under the semi-skilled and skilled classification. On this basis, fourteen of the forty-two factories fall under the first head, with the remaining twenty-eight coming under the second.

The upper chart on page 935 gives the result of this classification.

Unskilled Workers Unstable

It is apparent that the turnover among plants employing mainly unskilled workers is much larger than in factories where the operatives are more skilled. In the former group, six out of fourteen, or 43 per cent, of the concerns have a turnover between 200 per cent and 250 per cent. Among the latter group, twelve out of twenty-eight, or 43 per cent, have turnovers between 100 per

COMPARISON BETWEEN THE ANNUAL RATE OF LABOR TURNOVER IN THE 14 PLANTS EMPLOYING MAINLY UNSKILLED HELP AND 28 PLANTS EMPLOYING SEMI-SKILLED AND SKILLED WORKERS

Classified turnover (Percentage)	Plants Employing Mainly Unskilled employees	Skilled and semi-skilled employees
Under 50	1	3
50 and under 100	0	5
100 and under 150	0	12
150 and under 200	2	5
200 and under 250	6	2
250 and under 300	2	1
300 and under 350	3	0
Total	14	28

cent and 150 per cent. The difference between these two groups is most clearly shown by the actual figures.

At the present time the fourteen "unskilled" factories employ on the average a total of 8,506 persons and require 22,514 replacements annually. This means a turnover of 265 per cent. The twenty-eight plants using more highly skilled workers employ 32,869 employees and hire 41,174 replacements, which is a 125 per cent turnover. In other words, the turnover in plants employing principally unskilled workers is more than twice as large as in factories using mainly semi-skilled and skilled workers.

The following is a comparison between the food products and metal products industries, the two types of industry which were studied in greater numbers than the rest:

COMPARISON BETWEEN THE PRESENT ANNUAL RATE OF TURNOVER OF 11 FOOD PRODUCTS AND 10 METAL PRODUCTS PLANTS IN NEW YORK CITY

Classified turnover (Percentage)	Type of plant Food products	Metal products
Under 50	1	0
50 and under 100	0	1
100 and under 150	0	5
150 and under 200	2	3
200 and under 250	4	0
250 and under 300	2	1
300 and under 350	2	0
Total	11	10

The average rate of turnover for the food products group is 268 per cent, as compared with 112 per cent for the metal industries. Nearly 73 per cent of the former had a turnover above 200 per cent, whereas 90 per cent of the latter had a turnover of less than 200 per cent.

Four candy plants are included among the eleven plants classified as Food Products concerns. These employ on the average a total of 2,170 workers and hire 5,262 replacements. This is a turnover of 242 per cent.

It is possible to compare these figures with those of an earlier investigation. In 1914 the New York State Factory Commission made a report on the confectionery industry in New York City. Ten candy factories, with average forces totaling 953, had no less than 3,138 names on their payrolls during the course of a year. In other words, the turnover at that time was 229 per cent, as compared with 242 per cent at the present time.

Reasons for Low Labor Turnover

The reasons for the low labor turnover in the plants which reported a relatively small percentage of replacements may be determined in a general way. The following is a concise statement of reasons for the low figure as given by the management of a half dozen factories having a small annual percentage of turnover.

A

A Food Products Plant Employing Less Than 125 Persons

Though the majority of workers are unskilled, the annual turnover is less than 20 per cent. This is due in part to high wages and good working conditions, but more especially to the magnetic personality of the manager, who takes an active personal interest in his entire factory force. Through sympathy, tact and just dealing, he has bound his workers to him by close personal ties.

B

An Unusually Up-to-date Tailoring Establishment

The management takes a real interest in the welfare of its workers. Seasonal fluctuations have been reduced to a minimum. During the entire year ended June, 1920, this factory had practically no layoffs. Such steadiness of employment is very remarkable in a seasonal industry of this character. It is a very important consideration with the labor force, and the principal reason for the low turnover.

C

A Printing Concern Employing Union Labor Entirely

The relations between the management and their employees are very cordial, and as working conditions are excellent the men are loath to leave. Being union members, they would only receive the same wages elsewhere, while their surroundings would probably be less satisfactory.

D

A Factory Manufacturing Musical Instruments

Most of the employees are very highly skilled workers of the older type. They look upon themselves as craftsmen. Wages are high and work is steady. Moreover, the men have a superintendent they like. As a result, the annual turnover is less than 50 per cent.

E

A Rubber Goods Factory

Though the majority of employees are semi-skilled and many of the operations unpleasant, due to dust and odors, the company has kept down turnover by a liberal labor policy. The management takes a vital interest in the problems of its working force. Primarily, through the dynamic personality of the manager, a real factory pride has been created among the operatives.

F

A Candy Concern

This plant has given much thought and attention to its labor problems. It has a pension and a bonus system, provides free medical attention, gives vacations with pay, and so forth. These welfare schemes indicate the essential points, namely, that the firm takes a real interest in the health and happiness of its employees.

These reports indicate that while wages, hours and working conditions are of vital importance in reducing labor turnover, the most essential factor is the attitude of the management toward its working force. In all the factories where the turnover is low the employers stress the fact that they treat their workers well. As one employment manager put it, "We realize our hands have heads and hearts." There is no patent process of reducing labor turnover, but a feeling of fellowship between manager and men will go a long way toward lowering it.

Modern Aviation Engines—V

By K. H. CONDIT
Managing Editor, *American Machinist*

ON THE Italian front aviation activities were carried on under somewhat different conditions from those encountered in France. The rocky and mountainous territory which lay along the fighting front in the north made flying an extra-hazardous occupation because of the lack of landing places. On the other hand large cities, manufacturing plants and army and naval bases were within easy reach of the bombing squadrons of both the Italians and the Austrians and stimulated the early development of large day and night bombers of the Caproni type. Seaplanes also were largely used because of the shape of the Adriatic coastline, which is very favorable for minor naval operations assisted by aircraft.

In the early stages of the war the activities of the British and French air forces attracted so much attention that little heed was paid to the achievements of the Italian airplane engineers and designers. Fiat and Isotta-Fraschini, however, were hard at work on engines, and Caproni, Pomilio, Ansaldo and others were developing planes. The gigantic Caproni bombers first attracted attention to Italian developments principally because of their great size, but our commissioners when they reached Italy found many other advanced designs in production. For a long time the little S.I.A. scout was the fastest thing in the air and its stunting ability opened many eyes to new possibilities when it was brought to Mineola.

A squadron of these planes under command of Capt. Gabriele D'Annunzio bombed Vienna with propaganda leaflets and returned unharmed to their base. While this expedition probably had little effect on the enemy it attracted wide attention to the Italian service and probably helped to pave the way for the representatives of Italian airplane builders who came to this country, among whom was the son of D'Annunzio. The directors of our aviation policy hesitated between the Caproni and Handley-Page machines for our night bombing work and placed and canceled several orders for each type. There was great difficulty with plans and specifications which did not fit our practice and finally an agreement was entered into with the British under which we were to make the parts for the Handley-Page and they were to put them together at British aërodromes constructed by American construction units. At the same time orders were placed for a few Capronis but only one or two were finished before the armistice.

The Caproni biplanes had three engines, two tractors and a pusher and they were either Fiats or Isottas, whichever were available. With three Liberty engines their performance was very satisfactory and would undoubtedly have added greatly to the power of our air forces had the war lasted longer.

Various types of Fiat aircraft engines were built, some with six and others with 12 cylinders, but the type shown was most used. The 12-cylinder, 750 hp. type was for a time the largest airplane engine built and probably is the largest to be flown.

The Fiat six is in many respects much like the Mercedes. The overhead camshaft operates four valves per cylinder through rocker arms, and the magneto and water pump locations are the same in both engines. The carburetor and intake manifold are quite different, however. The Fiat uses a duplex carburetor mounted at the side of the cylinders, each side of the jacketed carburetor throat feeding three cylinders through a compound intake pipe.

The Fiat engines were equipped, for the most part, with an American-made magneto, the Dixie, on which certain slight alterations were made after delivery to the Italian factory. In addition to building airplane engines the big Fiat factory turned out machine guns, tanks, tractors, trucks, artillery, dirigible balloon engines and many other war necessities.

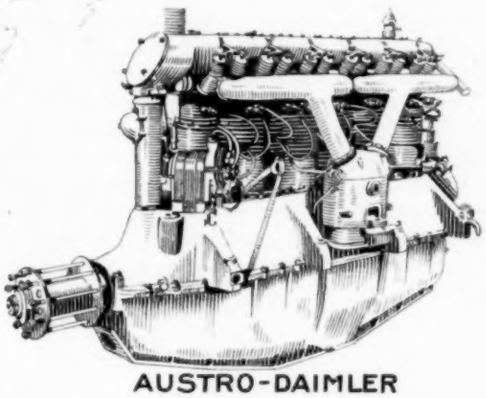
The six-cylinder engines developed by Isotta-Fraschini were not very different from the Fiat engines in size and performance as is evidenced by their interchangeability in the Caproni bombers. In details several sharp contrasts are apparent in the sketches. Where Fiat used individual cylinders with welded jackets, Isotta has two cylinder barrels surrounded by a single water jacket. The clean look which this arrangement gives to the engine is added to by the complete inclosure of camshaft, valves and rocker arms. Benz practice in fitting two separate carburetors is followed although the intake pipes do not seem quite so well arranged for good distribution of the explosive mixture, one of the most important features in the design of the successful aircraft engine. The Isotta design seems to have been particularly adapted to seaplane use as many of the Italian flying boats were fitted with them.

The other Italian engine shown, the Spa, is also a six and is more like the Fiat than the Isotta. It differs from both, however, in having only one inlet and one exhaust valve for each cylinder where they have two. This engine was used in several of the lighter Italian planes but received most notoriety in the S.I.A. scout already mentioned. The demonstrations of this plane given by Sergeant Gino were hair-raising and culminated in the crash which killed him when he attempted a spin too close to the ground while exhibiting the capabilities of the ship to General Kenly and other American officers.

The Austrian air forces opposed to the Italians were fortunate in possessing the Austro-Daimler engine at the outbreak of hostilities. The Austro-Daimler Co. had been among the pioneers in airplane engine design and construction and the early vertical six was so far in advance of its contemporaries that it furnished many ideas to the designers of such engines as our Hall-Scott and the British Beardmore. The Austrians used other engines but this one was by far the best known as their plan of concentration on one type was in accord with that of the Germans.

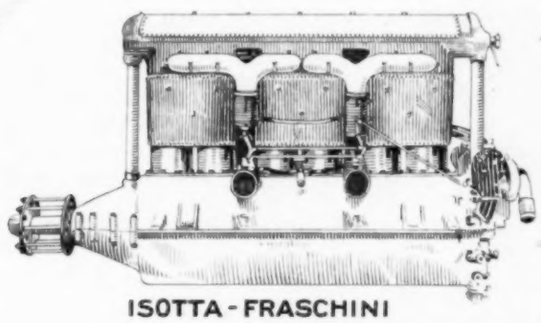
The cylinders resemble those of the Benz with their dual valves and corrugated water jacket plates but the camshaft is overhead like that of the Mercedes and is shifted endwise by the lever shown, to throw a secondary cam into contact with the exhaust valve rockers to relieve the compression for starting.

The stream-lining and clever use of bevel gears for auxiliary drives are features of these engines which stand out in the later models.



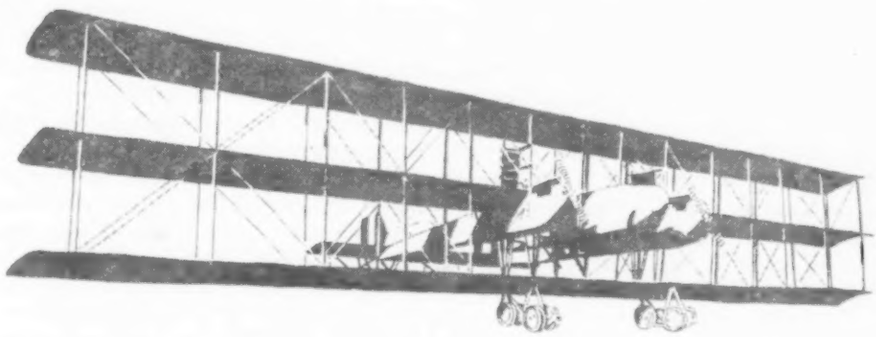
AUSTRO-DAIMLER

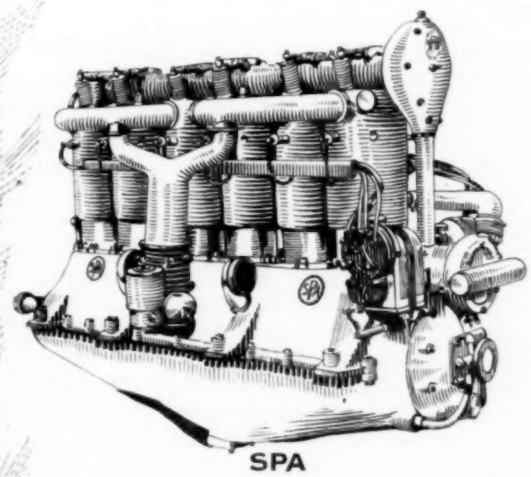
Six cylinders; bore, 5.7 in. (145 mm.); stroke, 6.88 in. (175 mm.); compression ratio, 5 to 1; rated h.p., 200 at 1400 r.p.m.; magneto ignition; dry weight per h.p., 3.64 lb.; fuel consumption, 0.555 lb. per b.h.p. hr.



ISOTTA-FRASCHINI

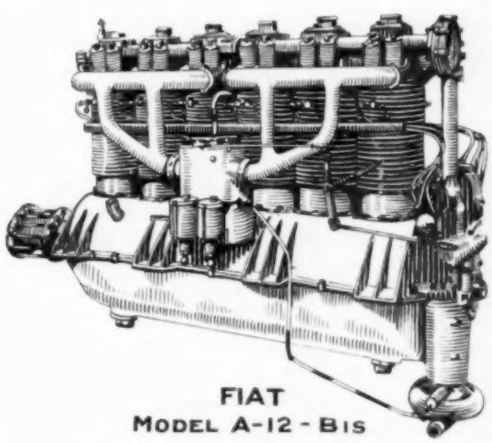
Six cylinders; bore, 5.2 in. (130 mm.); stroke, 7.1 in. (180 mm.); rated h.p., 190 at 1400 r.p.m.; magneto ignition; dry weight per h.p. 3.01 lb.; fuel consumption 0.47 lb. per b.h.p. hr.





SPA

Six cylinders; bore, 5.31 in. (135 mm.); stroke, 6.96 in. (170 mm.); compression ratio, 5 to 1; rated h.p. 200 at 1600 r.p.m.; magneto ignition; dry weight per h.p., 3.21 lb.; fuel consumption 0.473 lb. per b.h.p. hr.



FIAT
MODEL A-12 - BIS

Six cylinders; bore, 6.3 in. (160 mm.); stroke, 7.09 in. (180 mm.); compression ratio, 4.31 to 1; rated h.p., 300 at 1600 r.p.m.; magneto ignition; dry weight per h.p., 3.32 lb.; fuel consumption, 0.49 lb. per b.h.p. hr.

Austrian plane design followed German practice quite closely and the tactics of their aërial squadrons were the same as those of their allies. Easy marks for bombing squadrons were plentiful and within easy reach of the Austrian bases and only the most elaborate sandbag and timber protecting walls saved some of the finest Italian buildings from vandalism. Even these precautions were not sufficient to prevent the destruction of several priceless works of art when the buildings containing them were the targets for direct hits by high explosive bombs.

The Italian flying schools were selected by our own air service to train aviator cadets in the use of heavy bombing machines and several hundred of the early ground school graduates were sent to Italy for that purpose.

The Situation of the Machine-Tool Market in Czecho-Slovakia

By C. A. Heise

In surveying the development of the European machine-tool industry, Czecho-Slovakia may be singled out as having made particularly great strides. Before the war, the machine-tool industry of that new republic had to fight against foreign competition and the quality of the goods turned out was admittedly anything but first class. As to export, the quantity that went abroad was insignificant and most of the output was delivered to the government railroad works.

Since the war, however, there is a marked activity in the machine-tool industry. Apart from the fact that existing machine-tool factories are extending their plants with a view of turning out new types, a distinct tendency on the part of general engineering works is noticeable to specialize in the machine-tool line and it would appear that the banks are backing freely those new enterprises. The principal reasons for the extraordinary development are the following: Severe import restrictions on finished products on the part of the government; keen demand for quick deliveries by those industries which have resumed operations with the end of the war; exorbitant prices demanded by German machine-tool exporters as well as their conditions of payments; and last but not least the absence of American machine tools due to lack of tonnage and to the depreciated currency which rendered business difficult. To this should, of course, be added that the newly gained political freedom awakened a desire for economic independence as well.

There are about twelve to fifteen machine-tool works worth mentioning which, with one exception, are manufacturing general machine tools only; that is, lathes, drilling machines, planers, and shaping machines, while as regards special machines the industry of the country is almost entirely dependent upon foreign countries. As far as the import restrictions permit, the German machine-tool industry is practically supplying all demands to the exclusion of other countries but there is no reason to show why American machine-tool builders should not give more attention to trading possibilities in the Czecho-Slovakian market.

The obstacles caused by the exchange problem should not prove insurmountable. On the other hand, it should be realized that there is a wide demand for American machine tools; in fact, American makes are very popular and, if supplied on a large scale at right prices, they would stand a good chance of ousting German competition.

Another point in favor of the American machines is the outspoken animosity toward everything German; and it is mainly due to her favorable geographical situation, transport facilities, etc., that Germany has so far succeeded in retaining her leading position in the Czecho-Slovakian market. Austrian competition, on the other hand, is of secondary importance in view of the raw material and coal shortage obtaining in that territory which will probably last for some time yet. It should also be remembered that before the war considerable quantities of machine tools were imported from America and that their excellent quality found a widespread recognition, though some drawbacks of certain makes, particularly rapid wear of sliding parts, gearwheels, etc., did not remain unnoticed. These, however, are minor points only and should easily be remedied.

American and German Designs Copied

A close survey of the present situation shows that original designs are few and far between, most of the machines turned out being copies of good American and German types. While in general presenting a smart appearance, there is no gainsaying the fact that many of them have not yet attained that standard of perfection which goes with the name of a high-grade machine tool. There are only two or three factories manufacturing machine tools exclusively, while the line of manufacture of the rest comprises general engineering as well. Specialization has not advanced beyond the rudimentary stage as yet, the only special machines met with being one type of turret lathe, automatic, horizontal boring mill, high-speed lathe and thread cutting machine. Other special machines such as circular cold saws, grinding and milling machines, shears, presses, forging machines, etc., are hardly manufactured at all, which is the more surprising since the productive capacity and skill of the average workman is above normal.

Big Chances for American Products

From the foregoing it will be clear that the Czecho-Slovakian market offers vast opportunities for American machine-tool manufacturers once the present import restrictions are rendered less severe. Manufacturers of special machine tools should lose no time in opening connections with Czecho-Slovakian importers. In sending salesmen to Czecho-Slovakia care should be taken to select men possessing the right frame of mind. If they are going to adopt a "take it or leave it" attitude they will be well advised to stay at home or try to dump their goods in countries where German salesmen are conspicuous by their absence, for the tremendous development of the German industry during the last decade was due to the willingness of the German salesman to study the whims and individual wishes of his customers. The fact that a "Commercial Association of Czecho-Slovakian Banks"—working on the lines of a Chamber of Commerce—was recently formed at Berlin should serve as an eye-opener. The new association, being a joint stock company with a capital of 25 million marks, has been established with a view of furthering and extending commercial relations between Germany and Czecho-Slovakia and will make a specialty of financing commercial transactions. A branch office will be established at Hamburg with the principal object of promoting the export trade.

SEVEN CENTURIES of BRASS MAKING

By O. A. KENYON
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NEW YORK*

FOR a number of years brass makers have realized that the electric furnace offered many important possibilities for brass melting, but actual experiments were discouraging in that they revealed difficulties that for a number of years seemed insurmountable, or at least of sufficient importance to prevent the commercial utilization of electric furnaces for brass melting.

Before taking up the description of any particular type of electric furnace it may be well to consider the possibilities resulting from the mere substitution of electric heating for fuel heating. By looking at the problem in this way it will be evident that the electric furnace offers a solution of the brass melting problem only in the event that the proper type is chosen, and the mechanical design carried out in the light of experience in the melting of brass.

All electric furnaces eliminate the possibility of contamination of the metal from furnace gases since there is no fuel used and therefore no gases generated.

All electric furnaces possess the possibility of heat control, but not all possess even the possibility of temperature control when the matter of temperature distribution is considered. In brass making, temperature distribution is of first importance and a furnace that does not rapidly transfer the heat input to all parts of the metal without superheating any local portion, cannot be successfully employed.

On account of the fact that spelter floats on copper, it is necessary that provision be made for stirring the metal, and not all types of electric furnaces possess even the possibility of providing in a practicable way for this essential operation.

All types of electric furnaces may be so well insulated as to remove the disagreeable high-temperature conditions under which the men must work. Also any type of electric furnace may be mounted mechanically so as to facilitate the charging and pouring of the metal, thus reducing to a minimum the skill and labor required.

III. Using the Electric Furnace

It has been stated, in the preceding article, that while good brass can be produced by the crucible process, it is subject to variation on account of the great dependence which must necessarily be placed upon the human element entering into the control. The accompanying installment treats of the electric furnace, particularly its assistance to the maker in reaching a condition of exact control, which will insure a uniform brass.

(Part II was published in the Nov. 4 issue.)

Spelter Loss

All types of electric furnaces offer the possibility of enclosed operation, although the commercial realization of such operation is not always possible. Spelter loss depends not only upon enclosing the space above the surface of the molten metal, but also upon the temperature, the temperature distribution, the pressure, and the length of time that the metal stands in a molten condition. Consequently the effect of the electric furnace on spelter loss depends entirely upon the type and design of the furnace. Some electric furnaces would produce a spelter loss much greater than does the crucible process. In short, the electric furnace offers the possibility of applying scientific principles in a commercial way; that is, an electric furnace designed to utilize all the possibilities presented should parctically eliminate the personal element of the operator and render the process susceptible of accurate control in accordance with carefully worked out plans.

Electric Brass Furnaces

The Bridgeport Brass Co. for the last sixteen years has been conducting a series of investigations in its private laboratories for the purpose of reducing the process of brass making to scientific principles that could be effectively applied in the casting shop.

In the judgment of the company's investigators, the electric furnace offered the only possible solution of their problem. Accordingly, experiments were begun with electric furnaces and these experiments indicated

*Booklet published by the Bridgeport Brass Co., Bridgeport, Conn.

that even the best furnace designs on the market did not meet all the conditions which they considered necessary to the satisfactory solution of the brass melting problem.

Electric furnaces may be classified in various ways, depending upon the point of view. From a metallurgical standpoint the method of heat production may be classified as follows:

1—Heat produced exterior to the metal to be melted.

2—Heat produced on the surface of the metal to be melted.

3—Heat produced within the metal to be melted.

Separate Resistor and Indirect Arc Types

The first method includes the separate resistor-unit type in which the heat is generated in a special resistor and conducted to the metal to be melted through the walls of the hearth and by reflection from the arch or dome of the furnace. One disadvantage of this method is that special provision must be made for stirring. Then, too, the heat transfer from the surface toward the interior does not give favorable conditions for uniform temperature distribution throughout the mass of the metal.

Another type of exterior heat generation is the indirect arc. The disadvantages of this type are the same as in the resistor type except that the source of heat being more concentrated, the tendency to local overheating of the metal is correspondingly greater. In one type of furnace this tendency is combatted by constructing the furnace in the form of a cylinder swung on its long axis and rolling it continually first in one direction and then in the other. In this way the metal is mixed, the heat absorbed by the walls is equalized by contact with the metal, and the surface of the metal nearest the arc is continually changed.

Another type of indirect arc furnace which is successful in overcoming the tendency to local overheating is of the same general form as the furnace described in the preceding paragraph, except that it rotates continuously in one direction and pours from an opening in the end, while the oscillating furnace pours from an opening in its cylindrical surface.

Other than these disadvantages this type of furnace when properly designed may possess all the advantages previously listed. It also may be added that this method of heat generation is not the most efficient from the standpoint of energy economy and the size of the furnace is larger than necessary with either of the other two types.

Direct Arc Type

The second type, in which the heat is generated at the surface, is represented by a direct arc sprung between the surface of the metal to be melted and one or more suitable electrodes. The type of furnace on account of the excessive concentration of heat production is not considered suitable for brass melting and therefore will not be considered here.

Resistor and Induction Types

In the third type, the metal itself is utilized as a resistor and the flow of electricity through the metal may be established by induction from a primary winding, or the electricity may be introduced through electrodes. The disadvantage of this type of furnace is that a molten charge is necessary to start it. When properly constructed to utilize pinch effect, motor action, and heat circulation, this type of furnace can be built so that it will automatically circulate the metal and produce violent stirring with a resultant high degree of uniformity in temperature distribution.

For the high-zinc brasses the Bridgeport Brass Co. adopted the third type of furnace, using as heating elements the induction unit invented by J. R. Wyatt and controlled by the Ajax Metal Co.

The Wyatt heating element consists of an arrangement of circuits as shown in Fig. 16. The primary is connected to the alternating current source and may be wound for any commercial voltage. The secondary consists of a V-shaped mass of metal confined to narrow passages on two sides and open on the upper side. In the narrow passages three forces operate, namely: pinch effect, motor effect and gravity effect. The head of molten metal above the V in the chamber of the furnace

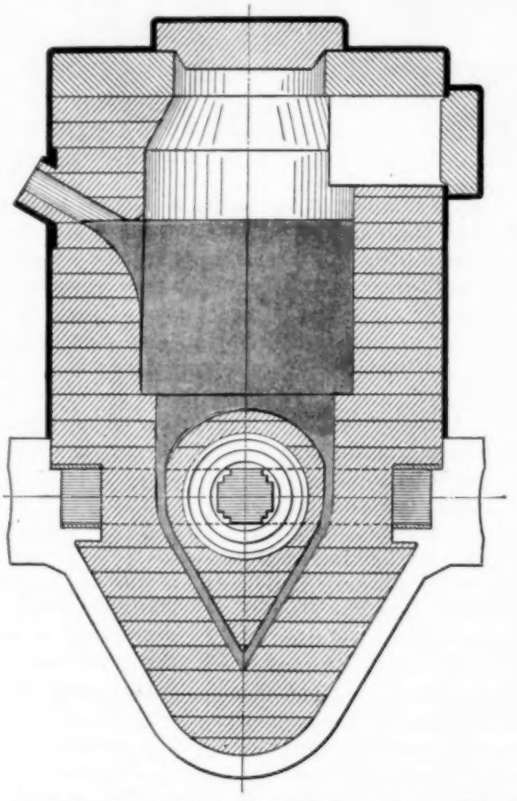


FIG. 16. ELEMENTARY DIAGRAM OF WYATT HEATING ELEMENT

prevents the pinch effect from actually rupturing the circuit, although it does cause contraction which results in motion of the column in the direction of least resistance. Contraction also results in the generation of extra heat which further accentuates the motion.

Theory of Operation

At any instant the electric current in the two converging channels is in opposite directions. Therefore, a repulsion, called motor effect, is produced between the two which tends to throw the liquid out of the passages. Observation has shown that the liquid rises along the outside surfaces of the passages and descends along the inside surfaces.

The application of heat at the bottom of the mass of metal causes circulation which draws the colder metal continually to the bottom and in this way effectively distributes the heat throughout the mass.

The combined effect of these three actions is to cause

a violent propulsion of metal out of both legs of the triangle, which thoroughly mixes the charge and carries the heat to all parts of the bath.

For other copper alloys such as bronze and phono-electric, the Bridgeport Brass Co. uses the indirect arc furnace of the Gillett type. This furnace is built in the form of a cylinder and is mounted in a cradle so arranged that the furnace is rotated automatically first in one direction and then in the other. The electrodes enter in the center of the two ends and coincide with the axis of rotation.

With these furnaces the Bridgeport Brass Co. is able to realize all the possibilities of the electric furnace as listed in the previous chapter; and since the casting shop is operated on the 24-hr. basis, and the grades of metal are thoroughly standardized, it has been possible to build furnaces that are exactly suited to the work they are to perform.

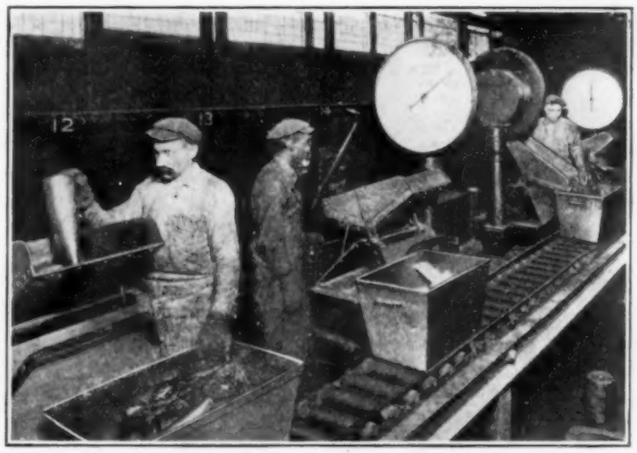


FIG. 19. A LINE OF WEIGHING MACHINES HANDLING THE INGREDIENTS OF THE STANDARD BRIDGEPORT ALLOYS

The Electric Casting Shop

Over three years ago the Bridgeport Brass Co. began to use electric furnaces on a commercial scale, and after developing types of construction suitable to the particular needs of the various alloys, steadily increased the electric equipment until it finally displaced the pit furnace entirely. Accordingly the pit furnace casting shops have been completely dismantled and the chimneys torn down. Figs. 17 and 18 show views of the shops when partially dismantled. The circular stack was only two years old, when it was decided that the best interest of the Bridgeport product demanded its demolition to make way for electric furnace brass. At the present time construction work is under way to more than double the productive capacity of the present electric casting shop. With these furnaces, the Bridgeport Brass Co. has been able to solve the problem of applying scientific principles to the making of brass for use in its sheet, rod, wire and tube mills and manufacturing departments. The process as developed possesses the following advantages:

1—The human element, as far as the actual operation of melting and pouring is concerned, is practically eliminated, because all of the factors which enter into the production of brass of a uniform and definite quality are susceptible of exact determination and control.

2—The heat input is generated within the body of the metal so that the temperature distribution is uniform.

3—The design of the furnace is such that stirring and mixing is thoroughly accomplished; in fact, the most conscientious brass caster could not stir a crucible as perfectly as the metal is stirred in these electric furnaces.

4—The temperature of the metal at various stages in the process is indicated electrically, eliminating entirely any question of skill on the part of the operator in the estimation of temperature.

5—The heat input and therewith the temperature of the metal is always under perfect control and can be adjusted to give any desired heating characteristic. Best of all, the same heating characteristic can be repeated indefinitely.

6—The purity of the metal is guarded by the exclusion of the atmosphere, the furnace chamber being entirely closed except when charging or skimming. A further precaution is the use of a layer of charcoal on top of the molten metal, which maintains a reducing atmosphere in the closed space above the surface of the metal.

7—The heat insulation is so perfect that the operator can lay his bare hand on the outside of the furnace at any time, which indicates the vast improvement in working conditions in the electric casting shop as compared with the pit-fire shop.

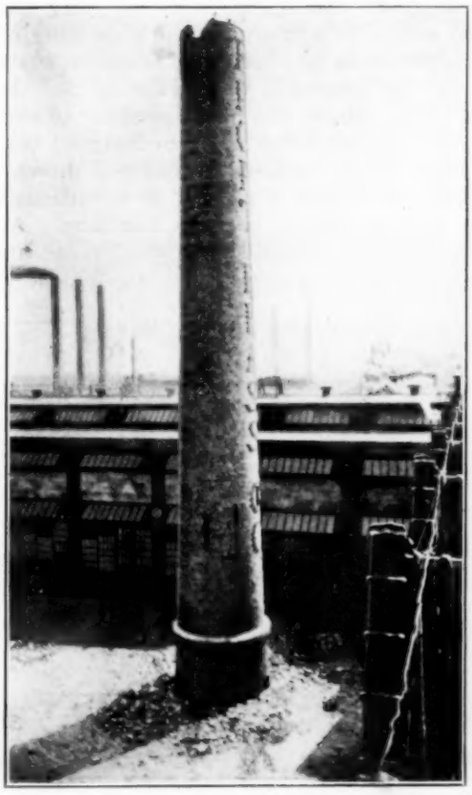


FIG. 17. THE TWO-YEAR OLD STACK BEING DISMANTLED

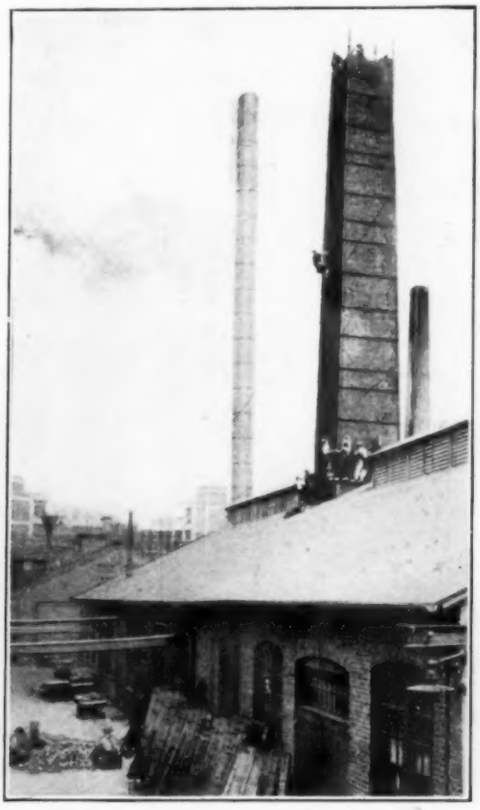


FIG. 18. PULLING DOWN THE OLD SQUARE STACK

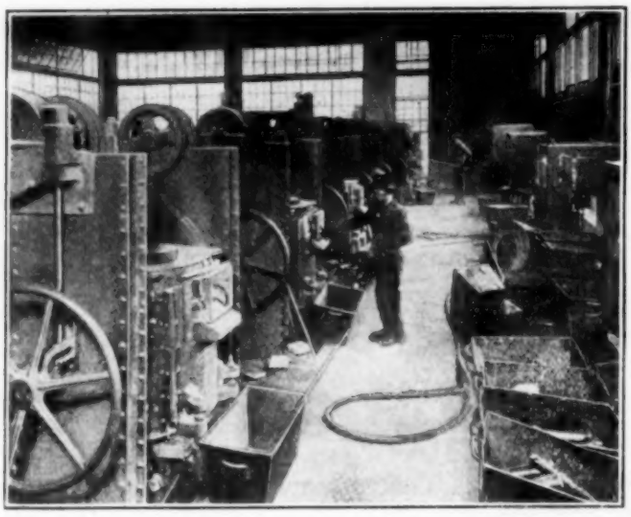


FIG. 20. THE CHARGING AISLE OF ONE BATTERY OF BRIDGEPORT ELECTRIC FURNACES

8—By pouring only part of a charge and then re-charging, any slight errors in weighing of the ingredients are equalized by the blending of several charges in the same furnace.

9—Mechanism is provided which gives the operator perfect control of the pouring. He can vary the rate as slowly and accurately as he may wish with the result that any ordinary operator can pour a billet as well as the most expert caster is able to do with the crucible by hand.

The combined result of these various factors is the production of a brass, uniform and homogeneous in quality and of a higher grade than is commercially possible with the crucible process. Due to the accurate control of the heating, the completeness of the protection from the atmosphere, and the entire absence of furnace gases, the composition of the metals is maintained to a remarkable degree of accuracy. In fact, practice has shown that the loss in spelter, so difficult to control with the pit-fire process, is less than one-half of one per cent.

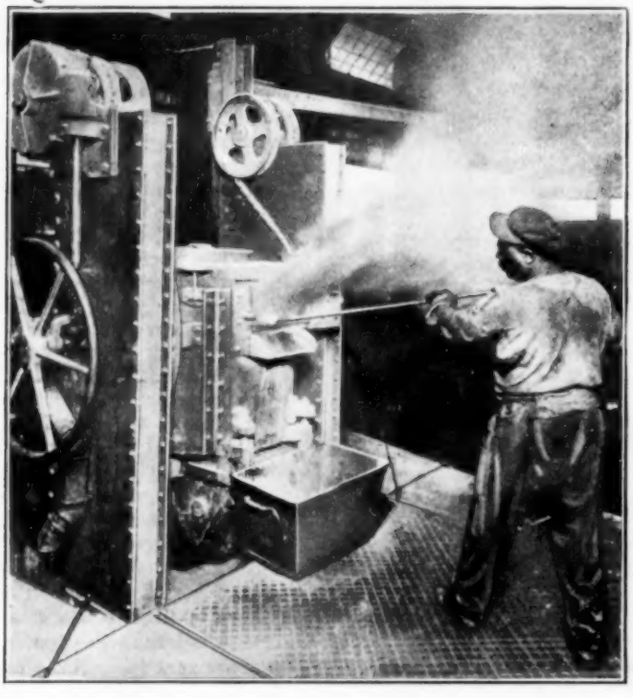


FIG. 21. SKIMMING ELECTRIC FURNACE PREPARATORY TO POURING

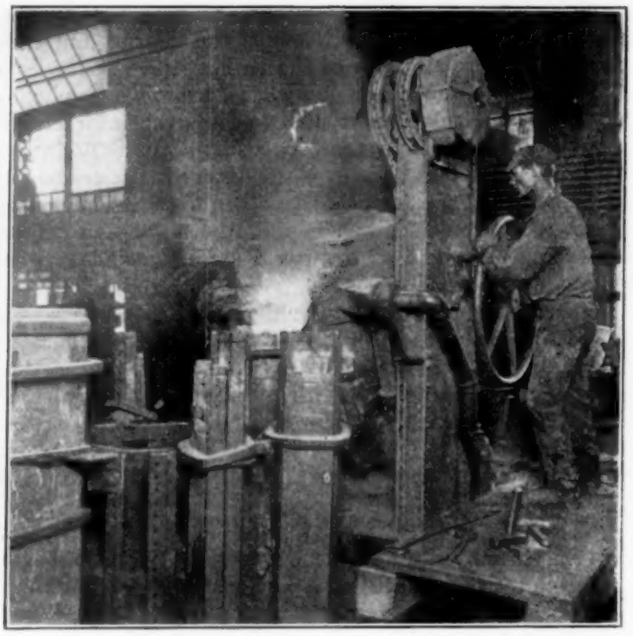


FIG. 22. POURING BRASS BARS FOR THE ROLLING MILL

At this point it may be interesting to describe briefly the operation of the electric casting shop in the Union Branch Plant of the Bridgeport Brass Co. At one end of the shop are situated the metal bins in which the raw materials, used in the making of brass, bronze and other copper alloys, are stored. These materials are carefully classified by systematic analyses so as to assure the maintenance of a high degree of accuracy in the composition of the brasses.

Weighing the Ingredients

In order to simplify the operation of weighing the ingredients and reduce to a minimum the possibility of errors, each ingredient is handled by a separate workman. In this way the process is worked out so that the weigher has only one weight and one ingredient to look after. The equipment for weighing is so designed that the material after being weighed is dumped directly into the charging can in such a manner as to eliminate the possibility of loss due to careless handling. All these precautions effectively safeguard the uniformity of the product. One line of weighing equipment is

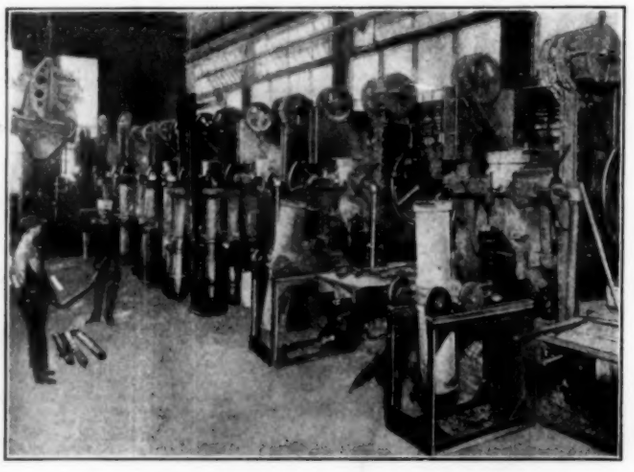


FIG. 23. THE POURING AISLE OF A BATTERY OF BRIDGEPORT BRASS FURNACES

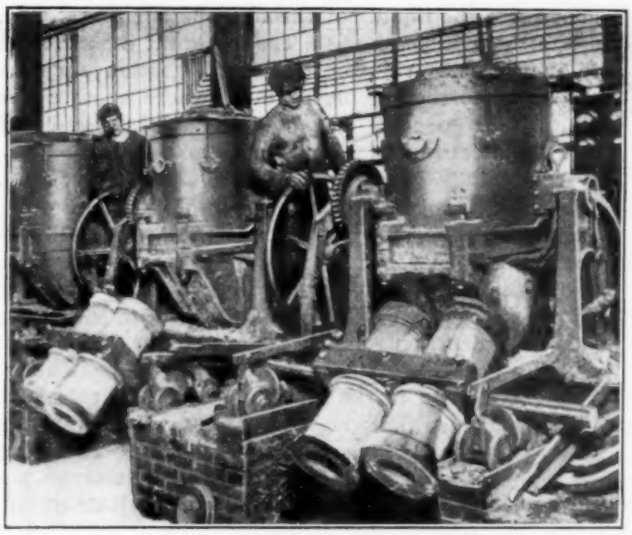


FIG. 24. A LINE OF INDUCTION FURNACES USED FOR POURING BILLETS

shown in Fig. 19. Each man has charge of only one ingredient and has to remember only one weight. In the background are seen bins which contain raw materials classified by careful analyses. It is scientific organization of this end of the casting shop that insures an extraordinarily high degree of uniformity in the composition of Bridgeport brasses and bronzes.

In order to obtain a positive check on every charge, the complete charge is weighed before it is sent to the casting shop, and if the total weight does not check exactly with the sum of the component parts, the charge is re-assembled.

CHARGING

The charging cans are made of such size that the charge fills them to less than half of their capacity. This procedure avoids the possibility of spilling any part of the charge before it is used. In Fig. 20 is shown the charging aisle of one of the lines of furnaces. The charging cans may be seen at the right. The materials are introduced into the furnace through the charging doors plainly shown in the picture. Before pouring, the furnace man skims the dross from the top through the charging door as shown in Fig. 21.

When the metal is ready to pour, the molds, mounted on a rotating stand, are put in place and the pouring accomplished by manipulation of a handwheel (Fig. 22). This wheel is positively geared to the tilting mechanism so that the caster has perfect control of the rate of pouring. At this point it is interesting to note that of each melt a sample is taken, and the results of the analysis of this sample are available before the billets or bars, as the case may be, reaches the mill to be worked into the finished product. A portion of one side of the pouring aisle is shown in Fig. 23. These furnaces are used for pouring billets that go to the tube mills and the extrusion machine. A line of induction furnaces used for pouring billets is shown by Fig. 24. The Bridgeport Brass Co. employs several kinds of electric

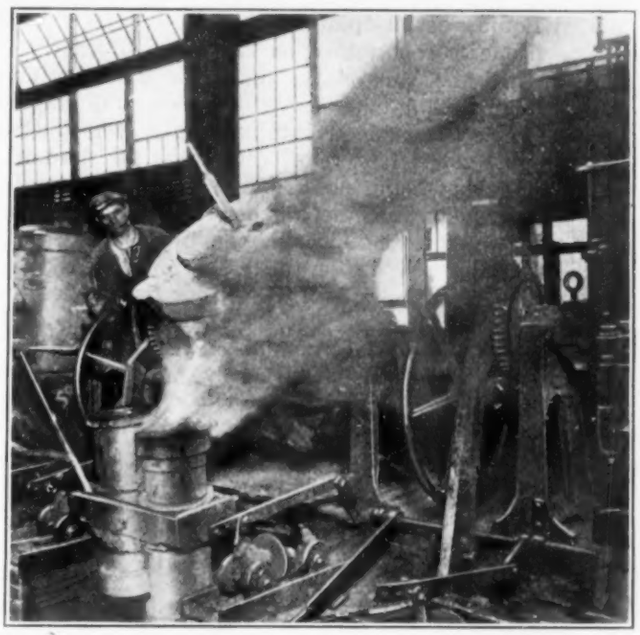


FIG. 26. BLACK SMOKE FORMED WHILE POURING A BILLET

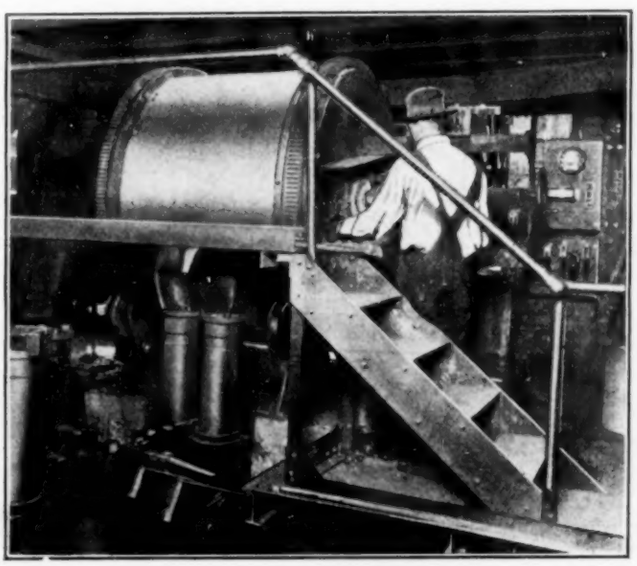


FIG. 25. POURING A BILLET FROM AN OSCILLATING INDIRECT ARC FURNACE

furnaces, each furnace handling the same alloy under the same conditions day in and day out. Fig. 25 demonstrates the pouring of a billet from an oscillating indirect arc furnace. The raw material is charged from a platform above the furnace. The pouring is manipulated by means of an electric controller. The black smoke, formed by the grease in the mold during pouring, is shown by Fig. 26. This smoke not only protects the mold from burning, but protects the stream of metal from the atmosphere and absorbs any oxide that forms.

Contrasting the actual operation of the electric casting shop with that of the pit furnace casting shop it will be noted that every one of the most difficult steps of the process is accomplished automatically and is practically independent of the skill of the operator. The heating, the judging of the temperature, the stirring, and the pouring, all of which formerly required the skill of a master caster are now accomplished by the furnace itself.

The accompanying illustrations will give some idea of the equipment employed and indicate how it is manipulated in service. With this equipment, the Bridgeport Brass Co. has been able to produce brasses

and bronzes of a degree of uniformity and homogeneity previously unknown on a commercial basis.

The entire output of the electric casting shop of the Bridgeport Brass Co. is made up into various products marketed by the company, such as tube, sheet, rod, wire and manufactured products. A fairly complete set of pictures has been made illustrating the most important steps in the various processes of manufacture. Beginning with the raw material furnished by the casting shop each one of these processes will be briefly described in future articles.

Pneumatic Painting Machine

BY M. KESTER

The accompanying drawings show the assembly and details of a portable pneumatic painting machine. The apparatus can be used for spraying whitewash and similar liquids, besides paints.

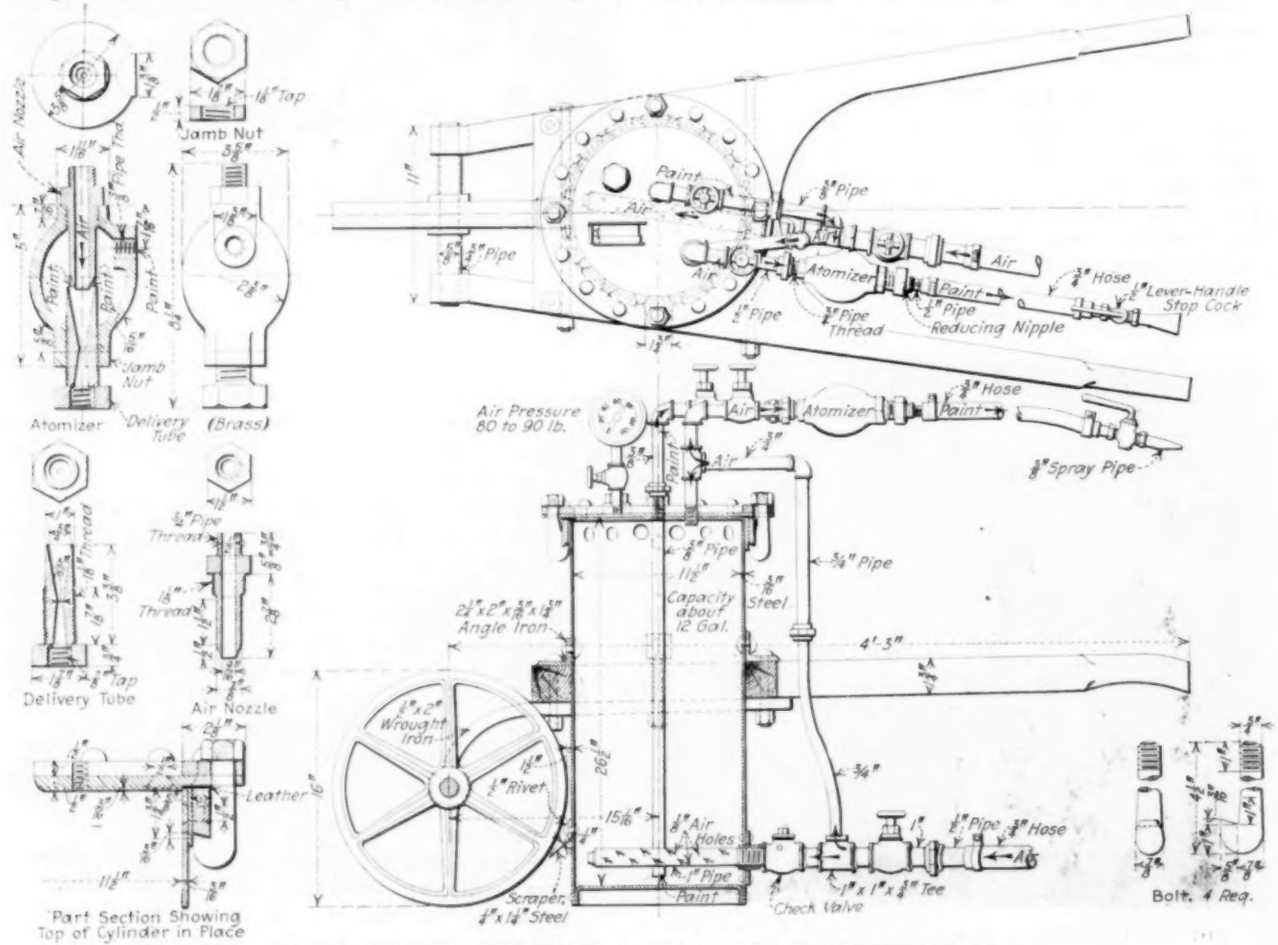
The frame is constructed on the order of a wheelbarrow; and the tank is 11½ in. inside diameter and 26½ in. long, although any convenient-sized tank may be used. The top is made removable with a ring riveted on the upper side. It is relieved where it fits the tank, a leather gasket being used, and it is secured on the tank by four bolts which hook under the bevelled edge of the band riveted to the upper part of the tank.

The short air pipe in the lower part of the tank has a number of ⅛-in. holes drilled in it for the purpose of keeping the mixture stirred up, the end being plugged. A check valve is directly outside of the tank, so that the pressure of the air on top of the mixture or paint cannot force the liquid out through the horizontal pipe. Close to this check valve is a Tee to permit the air to go both in the bottom of the tank for agitation purposes and also up to the top of the tank, where another Tee permits it to go down on top of the mixture and also out to the atomizer. An air gage is provided as shown, and the apparatus works best using 80 to 90 lb. pressure.

The paint or mixture is taken from the bottom of the tank and is forced up through the pipe which extends from within about ⅜ to ½ in. of the bottom of the tank into the side of the atomizer. Valves are provided on both the air and paint lines for controlling the action in the atomizer. From the atomizer the paint goes through a hose 25 to 50 ft. long, or even more if necessary. On the end of the hose is a ½-in. stop cock with a lever handle, so that the man handling the spray pipe can shut off the spray at any time desired. The spray pipe is simply a piece of pipe with the end flattened, and for overhead or other work as may necessitate it, the spray pipe can be 6 or 7 ft. long.

The atomizer is fully shown in the accompanying drawing, the air nozzle being screwed in solidly against the shoulder, while the delivery tube in the opposite end is screwed in so that the width of opening is suitable to the character of the paint or mixture being used. When the proper adjustment is obtained by trial, the jamb nut is tightened.

I have seen these painting machines in use in a number of different places, and I can say that they have proven very successful. The accompanying drawings give all of the information necessary for the building of the machine.



DRAWINGS OF A PORTABLE PNEUMATIC PAINTING MACHINE

Milling Operations on Herbert Lathes

By I. W. CHUBB
Editor, European Edition, *American Machinist*

Milling practice in English shops conforms quite closely to that in the United States. The accompanying illustrations give typical examples of milling work as carried out in a large English shop. The feeds and speeds given for the various operations will enable those doing milling work to compare their practice with that of a representative English concern.

THE notes here given relate to the milling practice of Alfred Herbert, Ltd., Coventry, England, more particularly as applied to the manufacture of their capstan and turret lathes. No attempt is made to show anything in the way of record-breaking, though larger outputs in the way of chips removed in a given time could easily be shown. For example, in surfacing with a 9-in. cutter, taking a cut 8 in. wide by $\frac{5}{16}$ in. deep, it is possible to remove 50 cu.in. of cast iron per minute, using a knee-type vertical milling machine. But commercial output is considerably below this; and in the practice of the firm it is found to pay better to run at speeds and feeds which will insure that a good-sized batch shall be machined without re-grinding the cutter, and, further, thoughts of high speeds and feeds subordinated to the consideration of finish. It may be well to state that in the examples here given all the cutters are of high-speed steel.

Considering first the machining operations on the No. 4 capstan lathe, Fig. 1 shows the use of the firm's No. 22 horizontal milling machine on the base of the lathe headstock. Here the rough surface of the casting is clamped down to points on the fixture, and the upper surface is machined in two operations. The three cutters are 6 in. in diameter, with inserted blades, each cutter being $3\frac{1}{2}$ in. wide. They are keyed on, with an adjustable collar between two of them in order to maintain the width of the gap. Here a comparatively low spindle speed is employed, in order that a good number may be machined without having to take down the cutters for grinding. For roughing, the spindle speed is 20 r.p.m., and for finishing, 39 r.p.m., the feed in the first case being $2\frac{3}{4}$ in. per minute and for finishing $3\frac{7}{16}$ in. per minute.

The same part is shown in Fig. 2, but it is inverted and clamped down to machined surfaces on the fixture. The cutters are of three diameters, the total width of the gang being $15\frac{1}{2}$ in.; an adjustable spacing collar is employed between the two largest cutters to maintain the width of the slot for the caps of the spindle bearing. The largest cutters are $8\frac{1}{2}$ in., the intermediate $7\frac{1}{2}$ in. and the small cutters 4 in. in diameter. Here again two operations—roughing and finishing—are employed, the spindle speed in each case being 20 r.p.m. The width of the cut varies, and consequently two rates of feed are employed. For the full cut the rate is $2\frac{7}{8}$ in. per minute, but in the spaces a speed of 12 in. per minute is used. One gang of cutters will machine 400 headstocks between the grindings.

Arbor Steadying Device

The square turret blocks for the No. 4 capstan lathe are made from steel bar of about 35 to 40 tons tensile strength. The bars having been machined to rectangular section, slots are cut in two pieces at a time, as illustrated in Fig. 3. The two side-and-face cutters are 5 in. in diameter by $1\frac{3}{8}$ in. wide, and the spindle runs at 25 r.p.m., the feed per minute being $1\frac{1}{2}$ inches. Here the work is finished in one cut. The arbor is supported between the cutters by means of the firm's patent roller steadyrest, a separate view of which is given in Fig. 4, which illustrates the fact that the device occupies no space below the arbor, so that cutters of minimum diameter can be used. This steadyrest is supplied as a standard fitting for machines and can, of

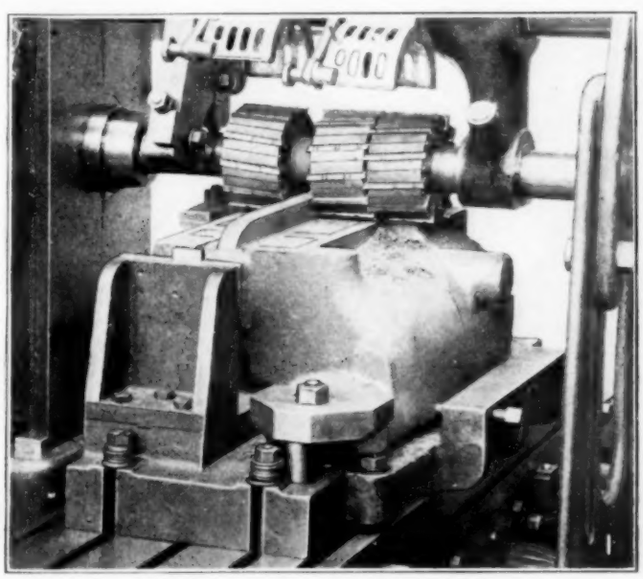


FIG. 1. GANG-MILLING BOTTOM OF HEADSTOCK BASE OF CAPSTAN LATHE

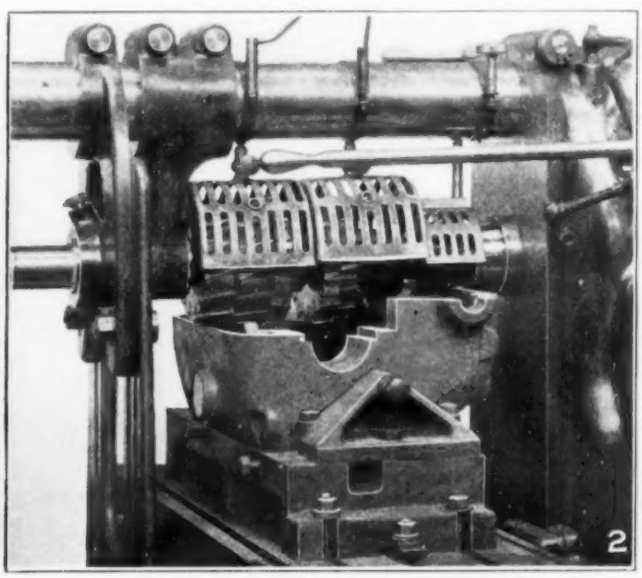


FIG. 2. GANG-MILLING TOP OF HEADSTOCK BASE OF CAPSTAN LATHE

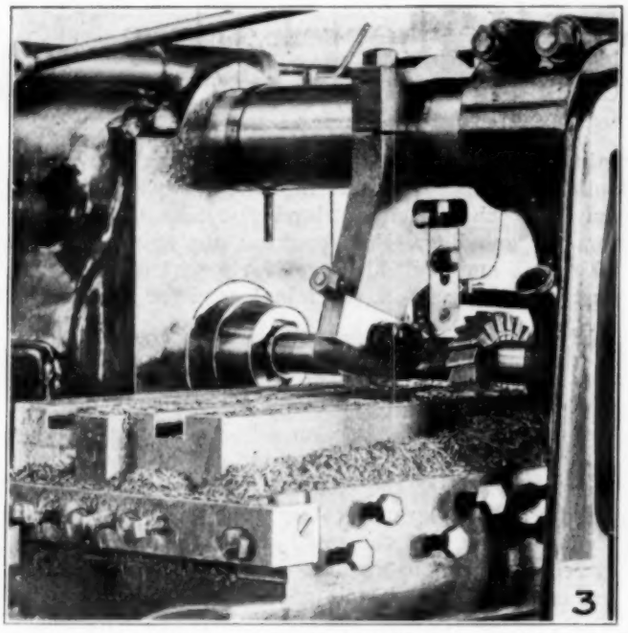


FIG. 3. MILLING SLOTS IN STOCK FOR TURRET BLOCKS.

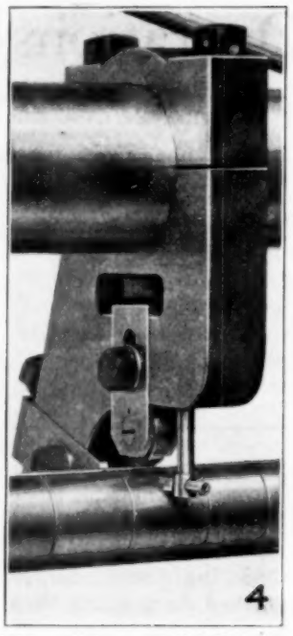


FIG. 4. ROLLER-STEADYING DEVICE FOR ARBOR

course, be used on jobs where the ordinary arbor support could not be applied. It is of special value where gangs of milling cutters have to be kept permanently on their arbors, as of course it can be applied or removed without taking away the cutters. The rollers are independently adjustable and a wiper prevents dirt and chips from getting between the rollers and the arbor. Chattering or spring can frequently be prevented by applying a steadyrest, without changing the cutter arrangement or even stopping the cut.

Still keeping to the No. 4 capstan lathe, In Fig. 5 a gang-milling operation is shown on the cross-slide, where the top, the ends and the slots are machined simultaneously. The gang of cutters includes a pair of 8-in. side-and-face cutters, a pair of 6-in. side-and-face cutters and four cylindrical cutters 3 in. in diameter, the total width of surface machined being 8½ inches. The spindle speed is 31 r.p.m. and the feed 1⅛ in. per minute. Here six castings are operated on at a time, the job being held in place by means of V-ways previously machined on the bottom. Done on the No. 22 horizontal milling machine, the operation is completed in one cut, and between 150 and 200 castings are machined between grindings of the cutter.

The milling of the T-slots in the cross-slide is shown in Fig. 6. The same fixture is used for securing the job and the T-slot cutter is 2 in. in diameter by ⅜ in. thick. The spindle speed is 93 r.p.m., and the feed 2¾ in. per minute, and between 250 and 300 castings are usually finished between grindings. This job, however, is done on a No. 16 vertical milling machine.

In Fig. 7 is illustrated the milling of rack teeth on phosphor-bronze gluts for the draw-in chuck of the No. 4 capstan lathe, a glut being a forked piece to transmit longitudinal movement to a rotating piece. It will be seen that the cutter consists of a gang of two angular hobs, 3 in. in diameter, the total length of the rock being 6 in. with a diametral pitch of 8. The speed of the cutter is 97 r.p.m. and the feed ⅛ in. The work is completed in one cut, the two hobs being staggered to split the load coming on the arbor. Each piece is held by a bar pushed through the previously reamed hole and pulled up by a knurled nut, the bottom end of the fork being set up by screws.

The operation shown in Fig. 8 is of interest, but the speeds and feeds employed, depending on circumstances, cannot readily be stated. Here is shown the machining of facings of white metal cast on gluts. Speeds and feeds are limited by the resistance of the white metal, because this would be torn away from the anchorage if pressed beyond the limit. The side-and-face cutters employed are 10 in. in diameter. The job is held much as described in connection with Fig. 7 and wedges support the pieces underneath. The two operations just referred to are performed on the firm's No. 12 horizontal milling machine.

A vertical milling operation on the sole plates of square turrets for the No. 4 capstan lathe is shown in Fig. 9, the pieces dealt with being drop forgings of about 35 to 40 tons tensile strength. The base and

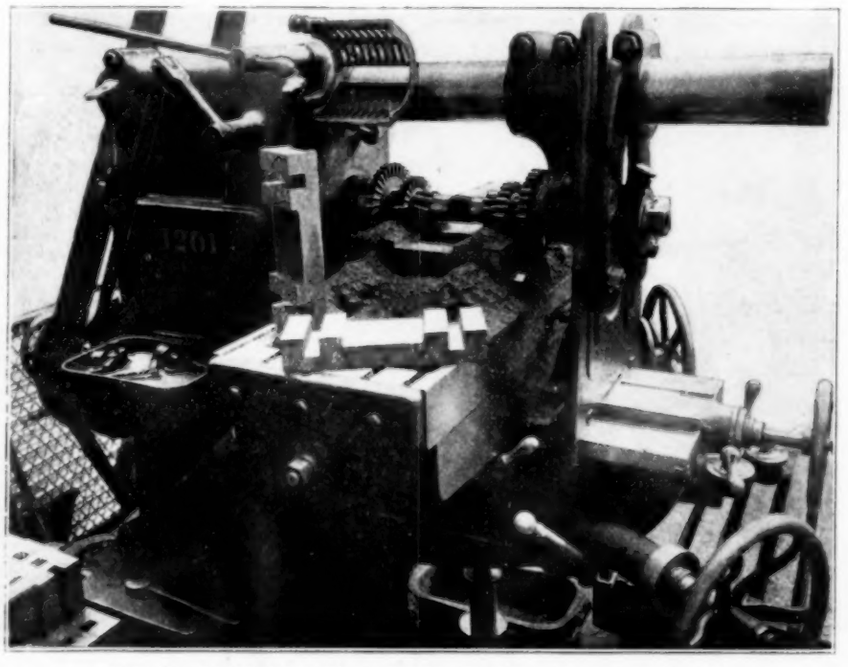


FIG. 5. GANG-MILLING CROSS SLIDES OF LATHE ON NO. 22 MILLING MACHINE

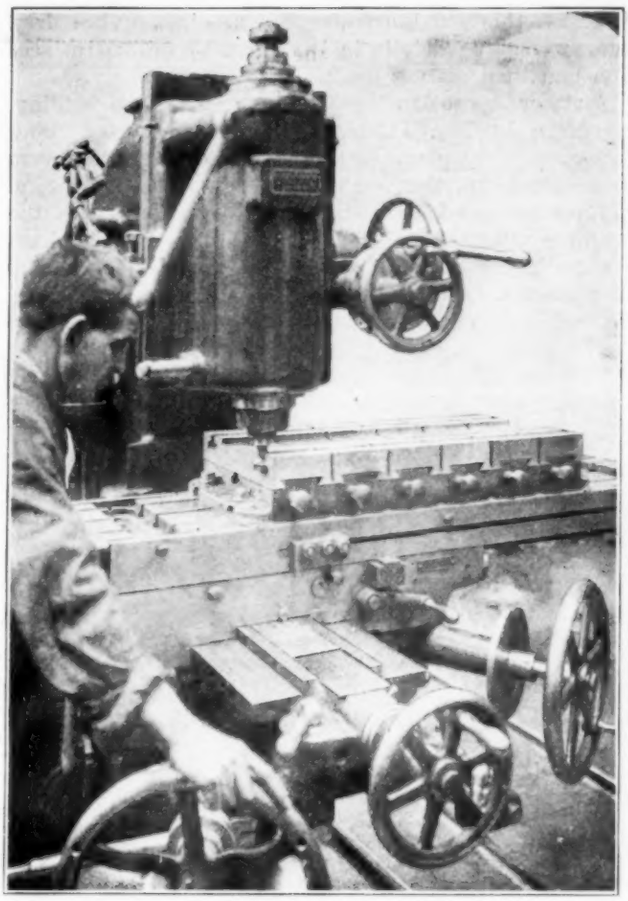
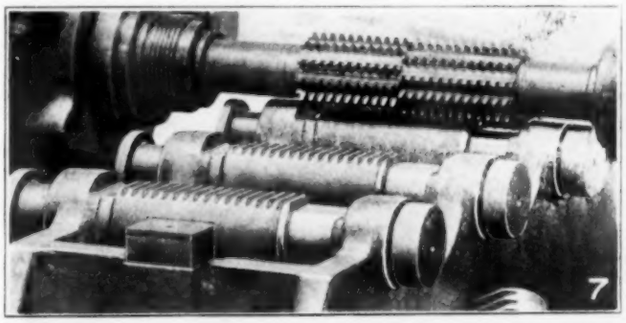


FIG. 6. MILLING TEE-SLOTS IN CROSS-SLIDES ON NO. 16 MILLING MACHINE

clamping-down tongue are both machined, and in order to mill the dovetail portion and the base, cutters of three types are necessary, the cutters being changed in the spindle without removing the work. The pieces are clamped up by setscrews against a knife edge. For the base a 3-in. inserted-tooth cutter is given a feed of 5⅞ in. per minute, and for the tenon an end mill 2 in. in diameter is used at the same feed, while for milling the dovetail an angular cutter is employed at a feed of 3⅛ in. per minute. For the latter a cross movement is given and no special positioning device is necessary, as the length of the dovetail tongue is not important within ¼ inch. A No. 16 vertical milling machine is employed. The illustration shows the first operation being performed.



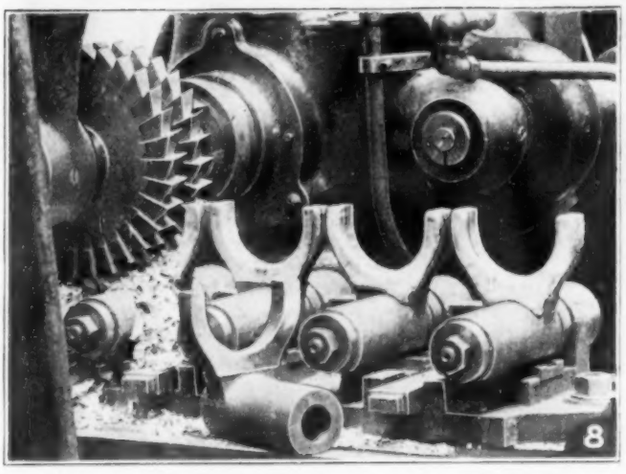


FIG. 7. MILLING RACK TEETH. FIG. 8. STRADDLE-MILLING WHITE-METAL FACINGS ON GLUTS

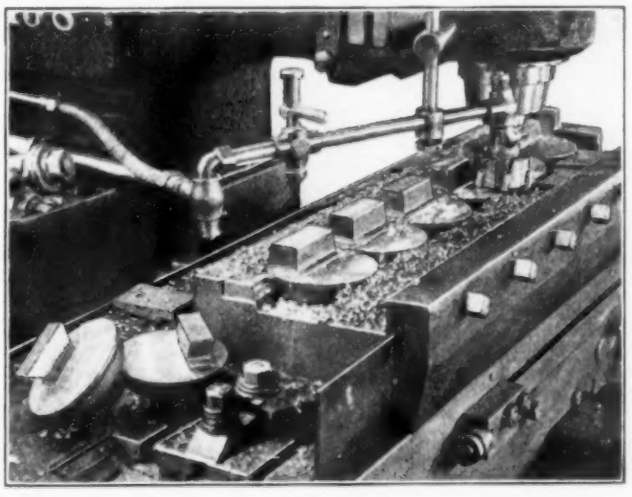


FIG. 9. MACHINING SOLE PLATES OF SQUARE TURRETS

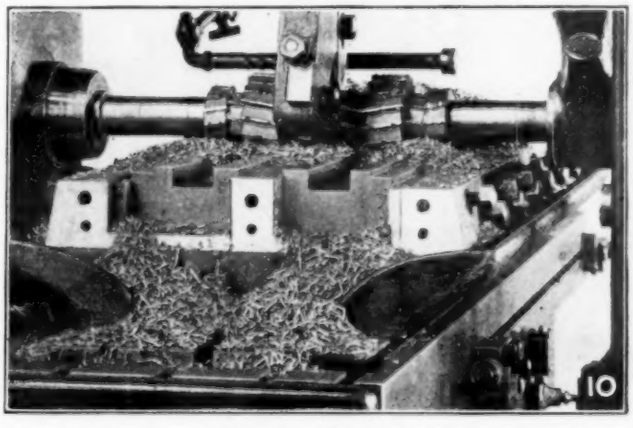


FIG. 10. GANG-MILLING TOOLSLIDES IN THE BAR

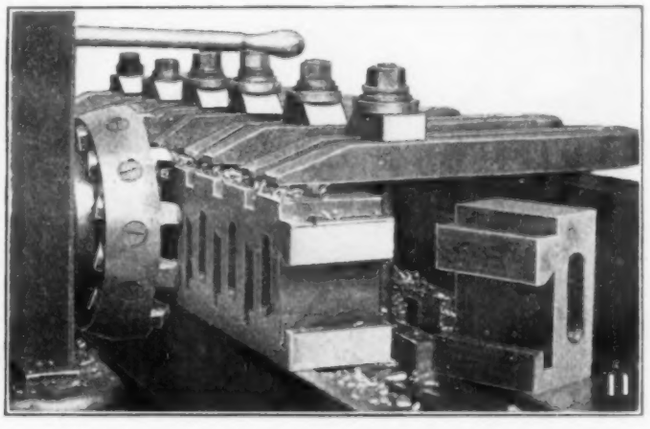


FIG. 11. FACE-MILLING ENDS OF TOOLSLIDES

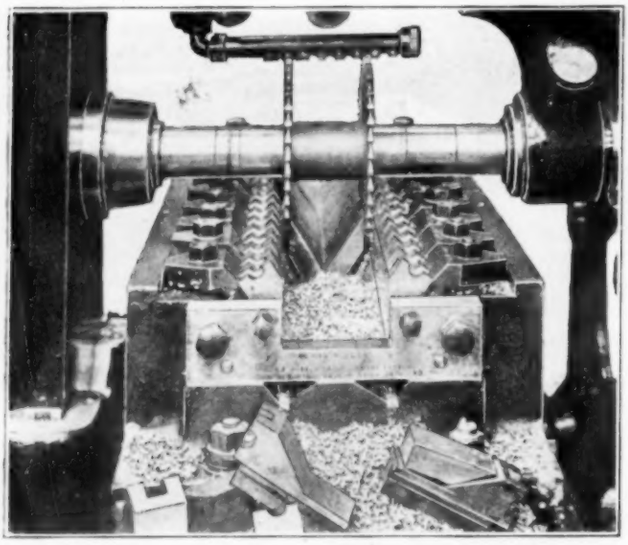
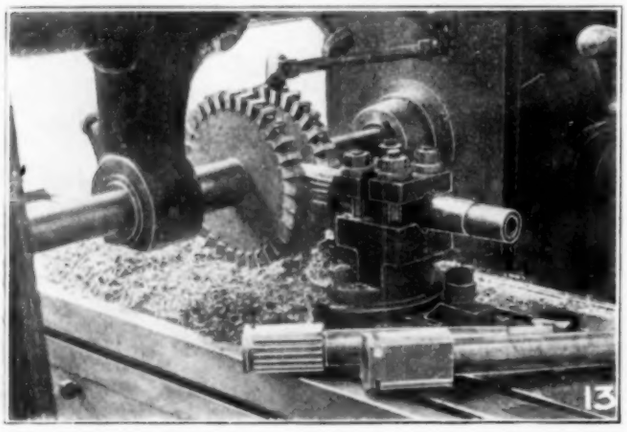


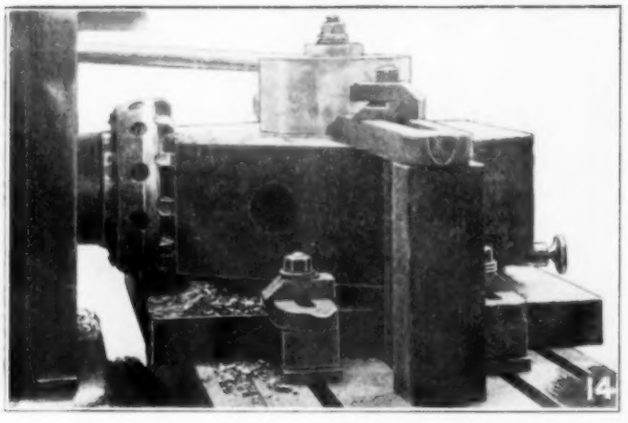
FIG. 12. MILLING OUT A BLOCK OF METAL BY THE INTERSECTION OF TWO CUTS

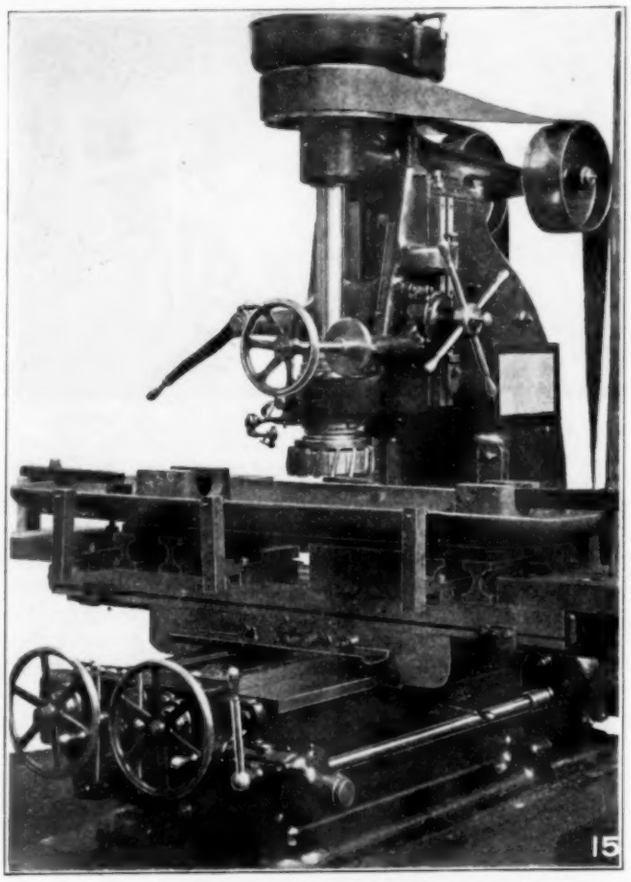
Turning to hexagon turret-lathe details, Fig. 10 refers to the machining of toolslides for the roller-steady turning tools employed. A steel bar of about 35 to 40 tons tensile strength is used and a gang of cutters 10 in. wide is employed, the gang consisting of two side-and-face cutters 5½ in. in diameter, the other cutters being 4¼ in. and 3⅜ in. in diameter, respectively. The spindle speed is 25 r.p.m. and the feed 1 in. per minute, and the slots produced are 1¼ in. wide. The use of the roller steady is again shown. In another direction this job illustrates the practice of the firm, namely, making details in bar form by milling to section and then sawing up.

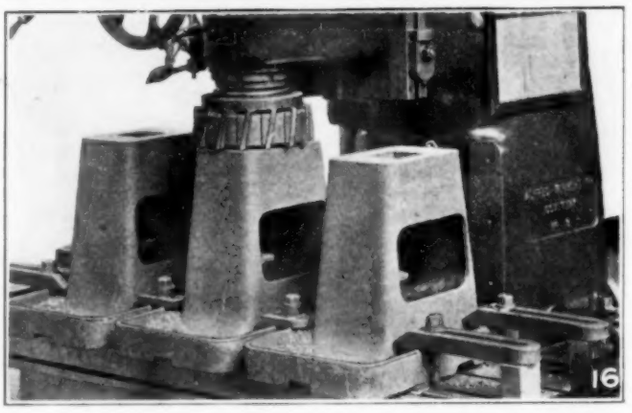
Another operation on the toolslides, face milling, is shown in Fig. 11, an inserted-tooth cutter being employed. The pieces are finish-milled after they have been sawed up, the work being light, and no special fixtures are used, the job being clamped down to the machine table with ordinary tackle and set up against a strip in one of the T-slots. The face cutter is 9 in. in diameter, the spindle speed 25 r.p.m., and the feed 2⅜ in. per minute, and the operation is dry. The machine used is a No. 22 horizontal milling machine.

The operation illustrated in Fig. 12 is particularly interesting, showing the milling away of a solid piece of metal by the intersection of two cuts rather than taking it out by slab milling. The job is held better



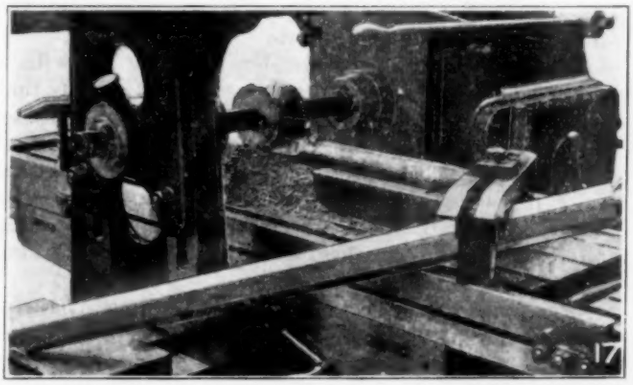


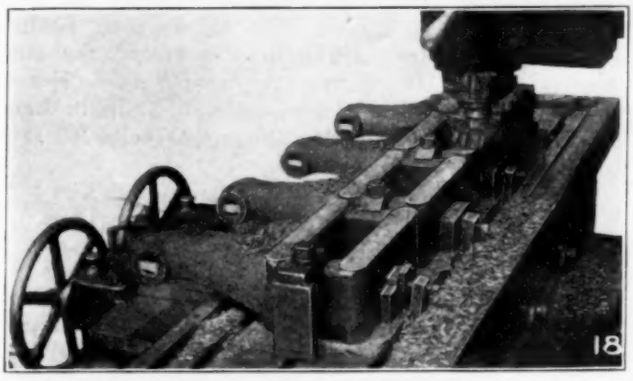


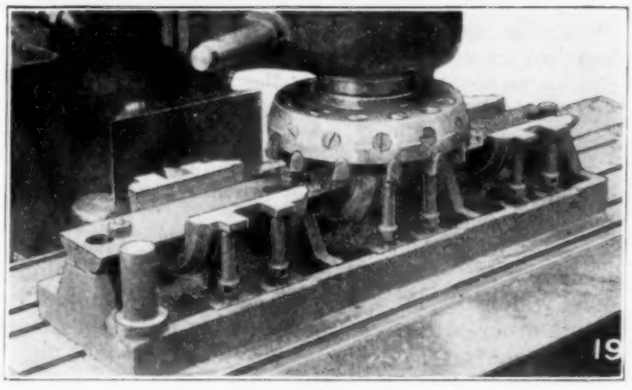


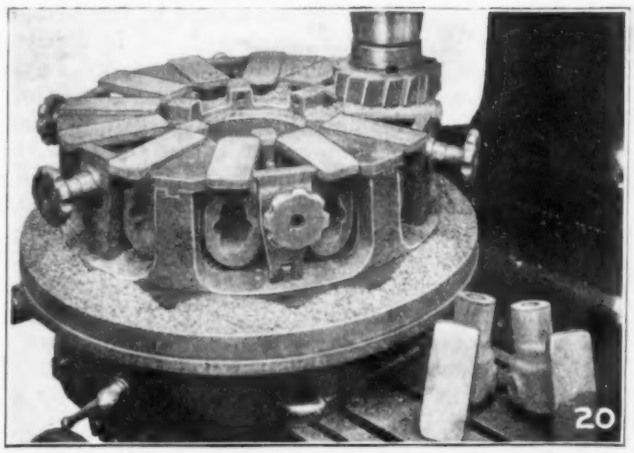
FIGS. 13 TO 16. SOME OF THE OPERATIONS

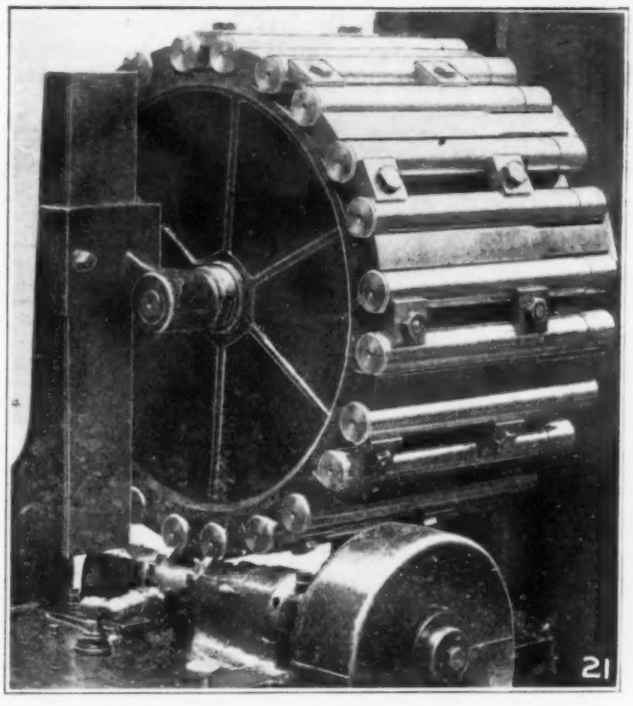
Fig. 13—Straddle-milling glut pinions. Fig. 14—Face-milling sides of a hexagon turret. Fig. 15—Machining trays on No. 8 vertical milling machine. Fig. 16—Facing top of cabinets on a vertical milling machine.











FIGS. 17 TO 21. OTHER MILLING OPERATIONS

Fig. 17.—Milling three sides of a hexagon at one cut. Fig. 18—Face-milling stop-rod brackets. Fig. 19—Milling faces of a split bearing. Fig. 20—Continuous milling bases of pumps. Fig. 21—Fixture to hold work in a gear cutting machine while milling keyways.

and the cutting operation does not stress the material so much. The pieces produced are used on the roller slides for the roller-steady turners in the hexagon turret lathes, and the material is 0.5 per cent carbon steel, heat-treated. The slide as finished in this operation is shown on the table of the machine, and the operation illustrated, done by means of side-and-face cutters 8 in. in diameter by ½ in. wide, completes the removal of the wedge piece. The fixture employed holds 40 pieces by means of finger clamps. The strength of the cutters determines the feed, which is usually 1 in. per minute. the wedge piece. The fixture employed holds 40 pieces planers for packing and setting-up strips. The firm's No. 16 horizontal milling machine is used in this operation. Straddle-milling the glut pinions for the No. 13 hexagon turret-lathe headstock is illustrated in Fig. 13, the material being steel of 40 tons tensile strength and the cutters 10 in. in diameter. They run at 20 r.p.m. and finish at one cut, the feed being 1⅞ in. per minute.

Another face-milling operation on the No. 22 horizontal machine is illustrated in Fig. 14, the job being the turret of a hexagon turret lathe. Here a 9-in. face cutter removes about ⅛ in. of metal, the speed being 25 r.p.m., and the feed 4½ in. per minute. The castings are specially dense, chills being employed to insure soundness, and the milling operation illustrated is for roughing only, the turret face being finished in position on the machine by a facing tool carried in the lathe spindle. The use of the No. 8 vertical milling machine to finish the facings on the suds tray for a No. 1 hexagon turret lathe is shown in Fig. 15. The inserted-tooth face cutter is 12 in. in diameter, running at 19 r.p.m. with a feed of 5¾ in. per minute.

The operation of milling the top facing of cabinets for the No. 9 combination turret lathe is shown in Fig. 16, the machine being again a No. 8 vertical milling machine. The cabinets are clamped direct on the table and a 12-in. inserted-tooth face cutter is employed, running at 19 r.p.m., the feed being 5¾ in. per minute. As an average, 50 castings are machined between grindings.

The hexagon stop bars for the No. 9 combination turret lathe are produced from round mild steel bars,

and Fig. 17 illustrates how three sides of the hexagon are machined by a cutter which is 5 in. in diameter maximum, and 2⅞ in. in diameter in the center, revolving at 48 r.p.m., the feed employed being 4½ inch. The hexagon is, of course, produced in two cuts, and a completed bar is shown placed across the table, the machine used being a No. 22 horizontal milling machine.

Stop-rod brackets for the No. 9 combination lathe being milled in the No. 8 vertical machine are shown in Fig. 18, clamped direct on the machine table with ordinary shop tackle, this procedure being common with larger machines. The inserted-tooth face cutter is 4 in. in diameter, running at 57 r.p.m. with a feed of 5¾ in. per minute, and usually three dozen castings can be machined on the two sides before re-grinding the cutters is necessary.

In many of its machines, including, for example, the No. 4 capstan lathe, the firm uses cast-iron bearings lined with white metal, and Fig. 19 illustrates the machining of the joint of the bearings for the head-

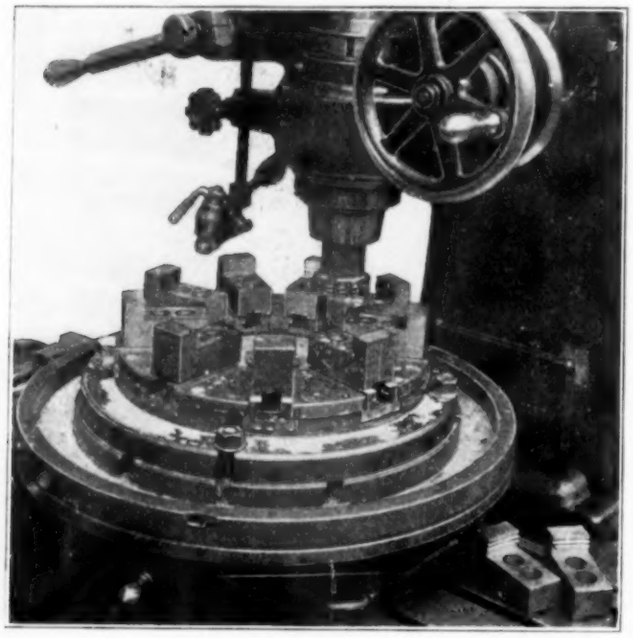


FIG. 22. CONTINUOUS MILLING SERRATIONS ON CHUCK JAWS

stock before the white metal is run in. The fixture shown takes three bearings, and is applicable to the bearings of other sizes of lathes by using different locating and clamping pieces. In the illustration a No. 16 vertical milling machine is shown, using a 10-in. inserted-tooth cutter at a speed of 25 r.p.m., the feed being 5⅞ in. per minute, finishing at one cut.

The remaining examples are of continuous milling. Thus Fig. 20 relates to machining the bases of gear-pump bodies used on the firm's machine tools. The fixture holds 10 castings, one side of the pieces under treatment being clamped against the base by the wedging action of the swinging clamps at the outside. By turning the knobs, the work is forced into V-shaped recesses at the center of the fixture, against wedge-shaped tongues, serrated and hardened, that are fastened in the casting. The fixture is secured to the circular table of a No. 3 vertical milling machine and rotates continuously under a cutter 7 in. in diameter running at 30 r.p.m. The work is finished in one cut, chucking proceeding simultaneously with the cutting. The depth of cut varies from $\frac{1}{16}$ to $\frac{3}{32}$ in. and the output is 40 pieces per minute.

A gear-cutting machine is shown in Fig. 21 with a fixture mounted on the work arbor to take 24 shafts that have to be splined. Two ways are cut simultaneously by means of a pair of 3-in. slotting cutters running at 80 r.p.m., the feed being $\frac{1}{16}$ in. per minute. The splines are $\frac{3}{8}$ in. wide by $\frac{3}{16}$ in. deep by 9⅜ in. long. The operation is continuous, the machine attendant loading and removing the finished work and, in fact, looking after several machines at once.

As a final example, the continuous milling of serrations on Coventry chuck jaws is shown in Fig. 22, the jaws having previously been finished on the surface to be serrated to within 0.010 in., so that only the teeth are required to be cut. On the fixture used, holding nine pieces, the jaws are secured in exactly the same way as employed for fixing them to the jaw slides of the chuck. The cutter is form-relieved, 2½ in. in diameter and runs at 120 r.p.m., the output being 30 jaws to the hour.

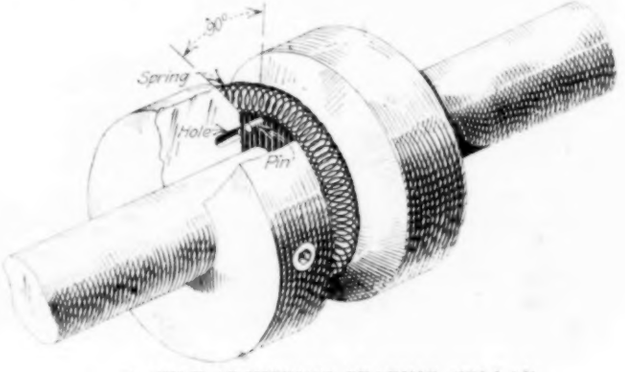
A Self-Adjusting Spacing Collar

By R. H. KASPER

Many machines carry a revolving shaft on which end play is undesirable. To overcome this end play a spacing collar is carried on the shaft, as between a pulley and a bearing. In time this collar wears and again permits end play, which necessitates making another collar. To eliminate the necessity of replacing collars the spacing collar shown in the sketch was designed and it exceeded all expectations. Instead of a single collar there are two collars of the same size which are placed side by side. Each collar has one edge turned so that when placed together a 90-deg. V-groove is formed.

A closely wound spring is then made with a loop at each end. One collar carries a pin on its inner face, which fits loosely into a hole in the inner face of the other collar. After the collar has been placed on the shaft the spring is stretched around the V groove and the ends hooked together. The pressure of the spring causes the two collars to separate, making a close fit in the space allotted to them. The pin keeps both collars moving as one, preventing wear on the spring.

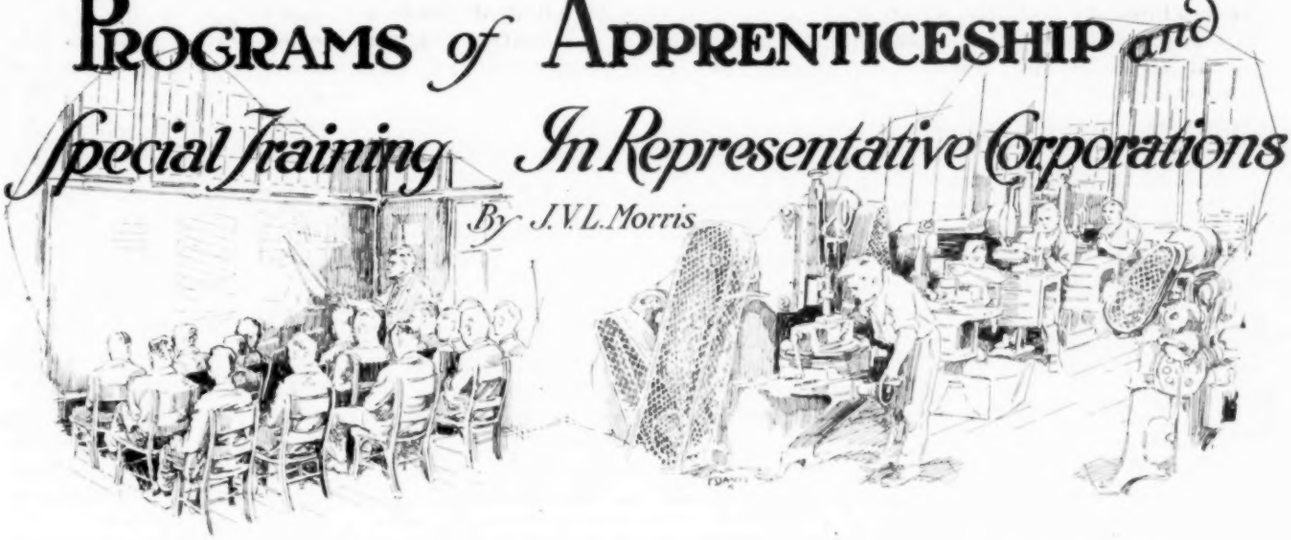
As the tendency of the spring is to close in towards the center, any wear on the outer face of the collars will immediately be taken up by the pressure of the spring. Although this collar adjusts itself readily, it will resist a very severe end thrust before closing together.



A SELF-ADJUSTING SPACING COLLAR

Programs of Apprenticeship and Special Training In Representative Corporations

By J. V. L. Morris



THE Sperry Gyroscope Co. has a splendid new machine plant in the city of Brooklyn, employing in the neighborhood of a thousand men. The products of the plant are a special type of searchlight, gun-fire-control instruments, radio apparatus, and, chiefly, the gyro-compass, for the production of which the shop was primarily established. A special training department has been organized under the administration of the employment department with an experienced mechanic in charge. Equipment is provided for training fifteen to twenty men at a time, this consisting of the usual machine-shop tools. There are, also, provisions for bench work and assembling and some toolmaking practice. Figs. 24 and 25 show views in the training department. Several skilled workmen are employed in the department to work with the men in training and to assist in their instruction. This department is intended to serve two purposes: First, as a "vestibule school," chiefly at times when considerable additions are being made to the working force, and second, for "up-grading" of selected employees during normal or slack periods.

As a vestibule school it offers an opportunity both to try out the fitness of men seeking positions and to give new employees a brief initial training in the practices peculiar to the plant. Upon this basis a workman ordinarily remains in the school for a period of only a few days to several weeks. He is then either rejected as unsuited to the requirements of the plant or, if satisfactory, transferred to regular production work. It is apparent that such a practice relieves the production department of the trouble of testing the qualifications of a new employee and of supervising his initiation into the special methods utilized by the company.

At the time of investigation, however, the second

V. The Sperry Gyroscope Co., Brooklyn, N. Y.

The system of training machinists used in a large-sized plant turning out complicated machines is described here. The method employed in operating the special training department might be useful in other types of machine-making plants. It should be noted that the training consists of a short-time apprenticeship for adult mechanics.

(Part IV was published in the Nov. 4 issue.)

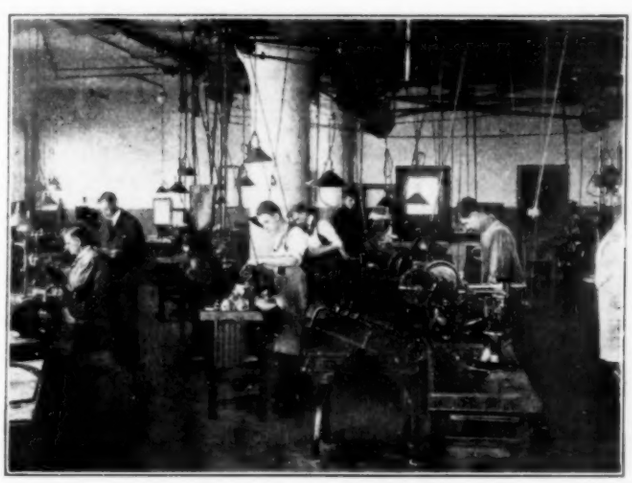


FIG. 24. MEN AT WORK IN THE TRAINING DEPARTMENT

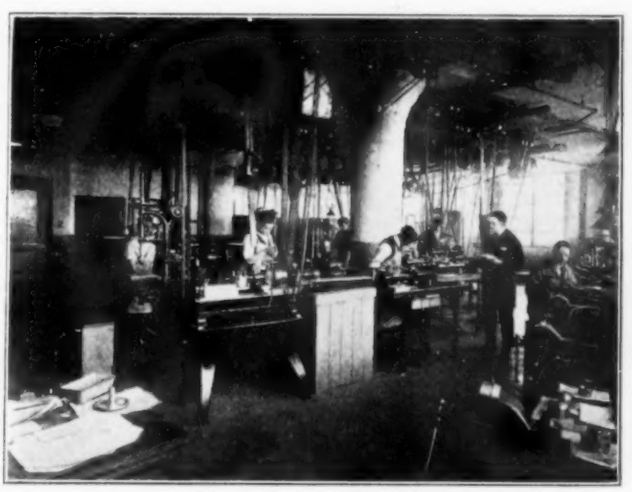


FIG. 25. ANOTHER VIEW IN THE TRAINING DEPARTMENT

Form # 1195-B SPERRY GYROSCOPE CO.INC.

EMPLOYE'S TRAINING RECORD

Name_____ Age_____ Clock No._____ Rate_____ Date Started_____ Time Started_____ A.M. P.M.

Former Occupation_____ With what Company_____

If former employe had already been in the Company's employ.

Occupation	Department	Foreman	Rate	Length of Service	General Character of Service rendered

Reasons for taking Training Work_____

Date of Transfer from Training Branch_____ Occupation_____

Transferred to_____ Department Foreman_____ Rate_____

Employe's Rating during Training (95% - 100% Excellent) (85% - 95% Good) (70% - 85% Fair) (50% - 70% Poor)

Ability Adaptability Attendance		Cleanliness Conduct Disposition		Health Honesty Initiative		Intelligence Leadership Loyalty		Neatness Patience		Average	

FIG. 26. RECORD KEPT OF EACH MAN BEING TRAINED FOR "UP-GRADING"

purpose, that of "up-grading," was being stressed. Some men from the shop were detailed for a 15-month course, and were receiving pay equal to approximately 80 per cent of the earnings they made while on production work. Several were at about third- or fourth-year apprentice age but most were somewhat older, though still young men. About half of the time was said to be spent on jobs selected particularly for value in training, and the rest of the time at small tool work of the regular production department. No organized, part-time, supplementary instruction in the way of drafting and shop arithmetic was provided by the company, though, of course, there was a larger amount of this instruction incidental to the assignment of jobs than would be customary in regular production.

The co-operation of the city public school system, however, offered provision for this purpose. The classes were held in the nearby vocational school directly after working hours rather than in the evening, an arrangement much more convenient to the men. The following classes were provided: Industrial arithmetic with fifteen enrolled, mechanical drawing with twenty-three, and applied electricity which, starting with fifteen, had grown to an attendance of thirty each night. Enrollment was not limited to those pursuing this special training, but was open to all employees.

Some interesting record forms have been developed. The one shown in Fig. 26 is utilized when the employee is undergoing the training for "up-grading." It will be seen that ratings at the bottom of the front face are not confined merely to workmanship, but extend to fourteen qualities, all of which are believed desirable in the superior workman, and that the final rating is an average of the different gradings.

The record on the reverse side of the form just mentioned is shown in Fig. 27, and it has been found a useful check on the time study for an operation studied by the enginering department and entered under "shop method." By the "training section method" a marked improvement has in some case been made, which method is, of course, later utilized by the production department. The other form, "the daily training record," in Fig. 28, serves for the new employees passing through the department for trial and brief initial training.

A School for Foremen, Supervisors and Inspectors

A rather unusual school has been developed for the foremen, supervisors, and inspectors. There are 111 of these enrolled, with meetings held twice a week from 4:30 to 5:30 p.m., directly after work. These meetings are given up to lectures by representatives of the engineering force on the products of the company, chiefly the gyro-compass, a knowledge of whose highly intricate construction and uses is both interesting and very essential to those whose duties consist in the production and assembling of the several thousand parts involved.

TRAINING RECORD

NAME OF PART	PART NO.	OPERATION	MACHINE USED	RATE OF PRODUCTION							PRODUCTION
				SHOP METHOD			TRAINING SECTION METHOD				
				QUANTITY	TIME	AVERAGE	START OF TRAINING	FINISH OF TRAINING	TIME	AVERAGE	

SPERRY GYROSCOPE COMPANY. Form #1114.

EMPLOYEE DAILY TRAINING RECORD.

Name_____ Clock No._____

This report to be also used for recording absence and lateness of employe.

Date	Name of Part	Part #	Assembling	Filing	Reading Blue prints	Measuring	Instruments	Drill Press, Sensitive	" Medium	" Multiple	Spindle	Engraving	Lathe, Bench	" Engine	Milling Plain	" Universal	Screw Machine	Shaper	Laying Out	Operation	Quantity Passed	Quantity Rejected	Time in hours	Average per hour	Total Production

FIG. 27. (TOP). PRODUCTION RECORD USED IN TRAINING DEPARTMENT. FIG. 28. (BOTTOM). DAILY TRAINING RECORD USED BY "VESTIBULE SCHOOL"

Handling Material in Railroad Shops

By FRANK A. STANLEY

Railroad shops usually do a large variety of work, and they are interesting because of the labor-saving devices that have been developed to suit the particular needs of the plants. The devices shown in the accompanying illustrations are typical of an up-to-date railroad shop.

THE value of special appliances for handling semi-finished and finished parts around the shop is generally recognized, and one of the most important features of many plants today is the equipment provided for just this purpose. Not only is material thus taken care of to good advantage without loss or injury, but, furthermore, there is a marked gain in economy of time and effort upon the part of the force. Also, heavy work may be done without danger to the workmen when suitable apparatus is in use for picking up and moving parts about the shop floors.

A few illustrations of equipment for handling railroad-shop work are herewith presented, these views being reproduced from photographs taken in one of the largest of the western plants, namely, the Southern Pacific shops, Sacramento, Cal.

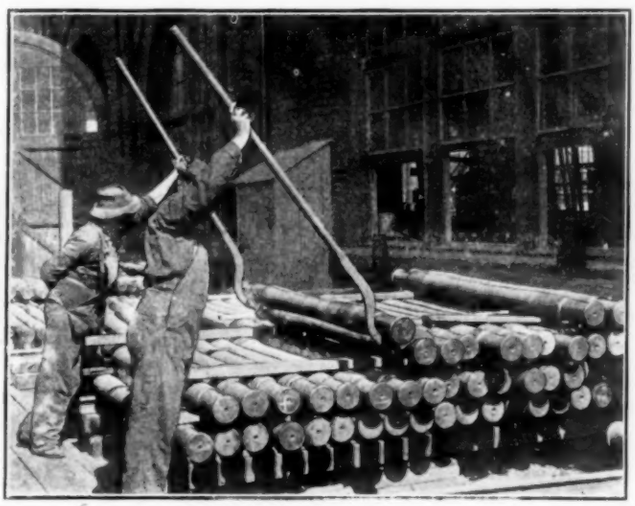


FIG. 1. USING HOOKED BARS FOR PILING AXLES

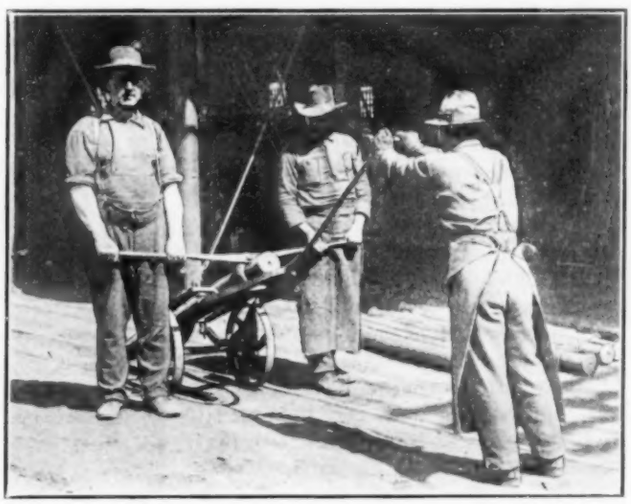


FIG. 2. TONGS AND TRUCK FOR HANDLING AXLES FROM PILE

In Fig. 1 is shown a method of piling axles with the aid of special hooks, which enable the men to roll the axles along from one tier to another without difficulty and with no liability of injury to hands or feet. These parts, weighing several hundred pounds, are usually more or less troublesome to stack up into piles where an ordinary bar is used, but the hooked bars shown take care of the job easily and safely. The end of the bar is formed into an S-shape, the outer end of which drops over an axle journal while the upper curve of the S fits under the journal of the axle that is to be lifted. With two hooks, one axle after another can be lifted up and rolled over the curved ends of the hooks into the tier above the one it originally occupied.

Another handy axle appliance is shown by Fig. 2, it being a combination of axle tongs and a truck. The truck is fitted with a steel cradle for receiving the axle, and when the end of the work is lifted by the tongs the truck is easily backed under it. The tongs are so made that when the axle is grasped between the jaws the handles form a straight line, and the axle can be picked up with the tongs held as rigid and straight as a single bar of metal.

A coupler truck is shown by Fig. 3. It is a two-wheeled vehicle with the axle raised at the middle to receive a horizontal tube clamped to the top of the axle. Links are fastened to the horizontal bar at front and rear, and in these are held rings for the short chains by which the coupler is suspended. The longitudinal position of the supporting bar for the coupler is such that the work is nicely balanced and can therefore be lifted from the floor with little effort. The looped handle at the end of the truck is proportioned for convenience in operating.

Another truck is illustrated in Fig. 4. It is used for handling air tanks for locomotives and for supporting them while they are being secured to the engine. The truck frame is of steel angles, light but sufficiently strong. Across the top are two flat plates carrying nuts fitting on 2-in. square-thread screws. The nuts are pro-

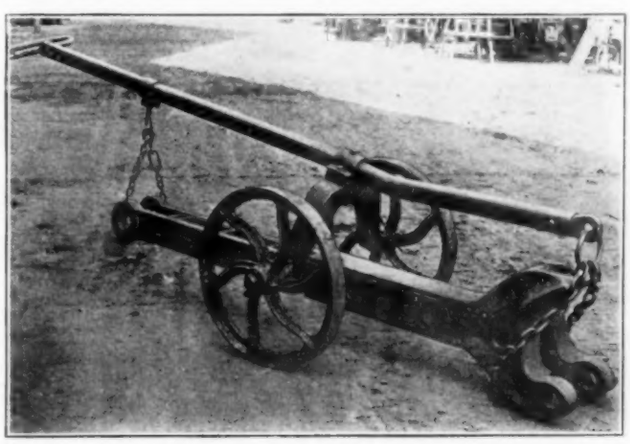


FIG. 3. TRUCK FOR HANDLING COUPLERS

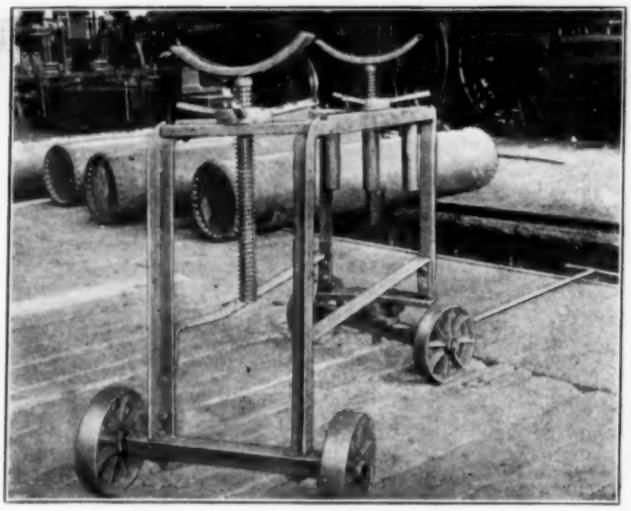


FIG. 4. TANK-SUPPORTING TRUCK

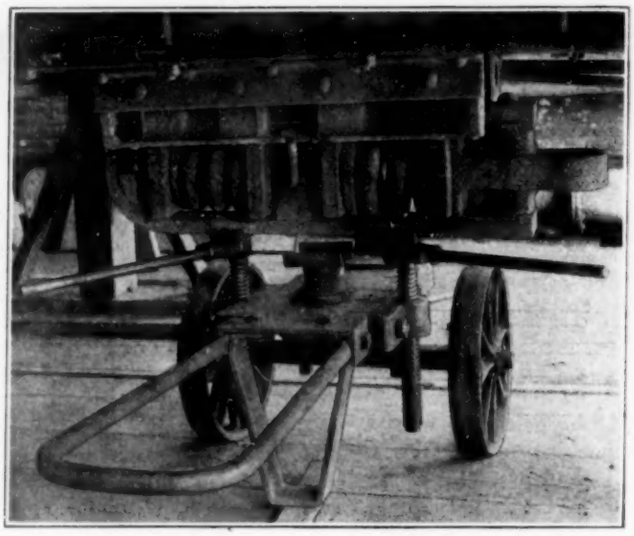


FIG. 5. TRUCK FOR HOLDING DRAFT RIGGING

vided with handles like pilot-wheel spokes, these being operated to adjust the long elevating screws by which the tank is lifted to the height required for the locomotive. The tops of the elevating screws are fitted with arc-shaped cradles of a radius to accommodate the diameter of the tank, and of a length of arc equal to about one-fourth of a circle.

Another truck built along somewhat similar lines is seen in Fig. 5. This one is for handling draft rigging. It is necessarily made with a low body and it combines with the truck features a double lifting jack both for forcing the draft rigging up into place and for holding it while it is being fastened permanently in position. The truck carries at the center of the body a supporting shoe or cradle to receive the work, and the elevating screws are similarly fitted with channeled shoes to suit the lower leg of the yoke. To elevate the screws, each is provided with a ratchet head and a long operating handle, so that the draft rigging can be quickly and rigidly jacked up into place as soon as the truck has been backed into position.

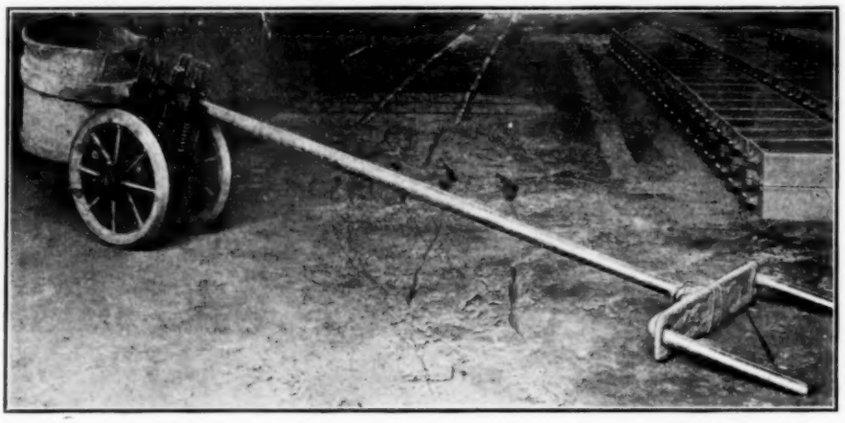


FIG. 7. A LADLE TRUCK FOR THE FOUNDRY

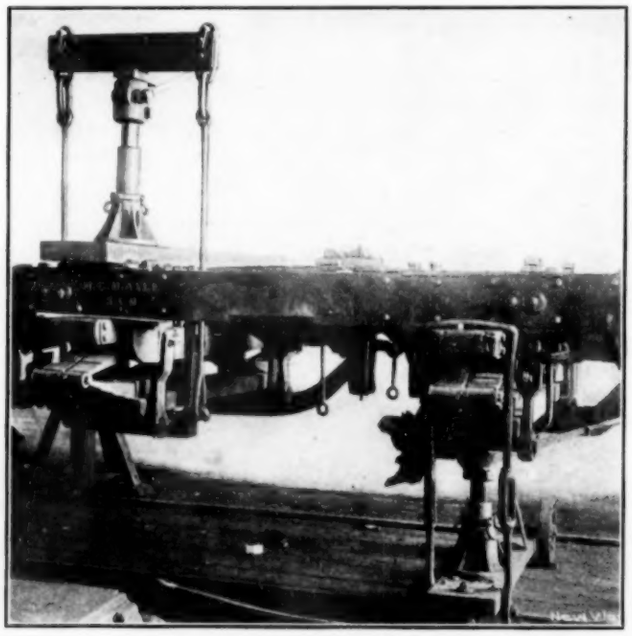


FIG. 6. SPRING-CLAMPING DEVICES. OLD METHOD AT LEFT, NEW METHOD AT RIGHT

In Fig. 6 are illustrated two methods of applying spring clamping devices; at the left is shown the old way, at the right the new method. The advantages over the old method as regards both convenience and safety are well brought out by comparison of the two arrangements. With the newer method, instead of lifting the spring from the top, the jack and its slings are carried beneath, the truck with the jack being run back directly under the job where there is no opportunity for the work to drop. The device is very compact and as readily handled about the shop as an ordinary truck, since it is practically self-contained.

One more form of truck is shown in Fig. 7, which illustrates a truck for handling ladles filled with molten metal about the foundry. The ladle is carried in a ring at the end of a long handle which passes through a bracket on the truck. The support from the truck axle is by means of four coiled springs, which are heavy enough to support the weight imposed upon them, but which also insure easy riding of the ladle and enable the apparatus to be run over the floor without shock and without danger of the metal being spilled when moving from flask to flask.

A Device for Grinding Hacksaws

By Eugene E. Henry

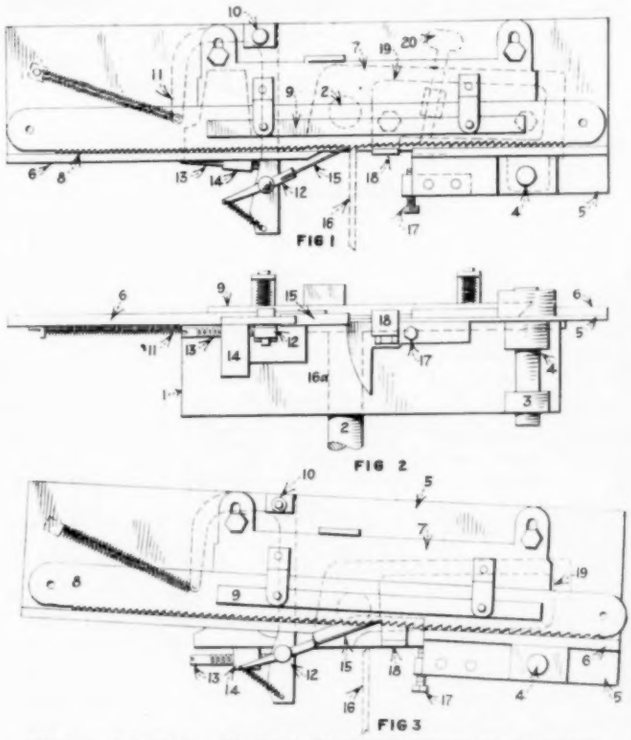
During the war we installed a hacksaw grinding machine and used it some months in regrinding our hacksaws. Being in charge of the tool grinding, it fell to my lot to keep this machine going when I had work for it, and in this way I learned something of an easier way to do it.

I learned at once that very few saws were straight on the front and back and with the machine we had, if the saw was concave on the front, the operator had to keep adjusting the wheel the full length of the saw or it would only hit on the top of the tooth at the center and cut the face away at each end. If the saw was bowed up in the center, it would grind harder and harder as it approached the center or get the same effect as if the saw was wider in the middle.

With crooked saws, straight saws, and some even with two or more different crooks in the face and back I realized that it was almost impossible to grind them on a machine in which the saw fed through on its back. I found that to overcome the difficulties imposed by these conditions it was necessary to make a complete departure from any standard practice, hence the device described herein which avoids the above difficulties and increases the output five times. It has the further advantage of low cost, and of producing better work than the standard machines and can be used on any grinding wheel stand. Fig. 1 is a top plan view of the complete device, showing the saw in contact with the grinding wheel. Fig. 2 is a side elevation of same but looking from behind the grinding wheel. Fig. 3 is a top plan view showing the saw out of contact with the grinding wheel.

1 indicates a stationary base made of a section of L angle iron and is provided with a rigid vertical post 2 which fastens on to grinding stand in the place of the toolrest (see Fig. 4). At the left-hand end of base 1 is mounted in bosses 3 a vertical shaft 4 secured to plate 5. Shaft 4 supports plate 5 above base 1 and allows a horizontal motion to plate 5 pivotally on shaft 4.

The front edge of plate 5 next to the grinding wheel, which is shown at 16, is provided with a guide bar 6 extending its full length, with a portion cut out of the center to allow wheel 16 and spacer or feed finger



FIGS. 1, 2 AND 3. PLAN AND ELEVATION OF DEVICE FOR GRINDING HACKSAWS

Fig. 1—Grinding position. Fig. 2—Front view. Fig. 3—Spacing position.

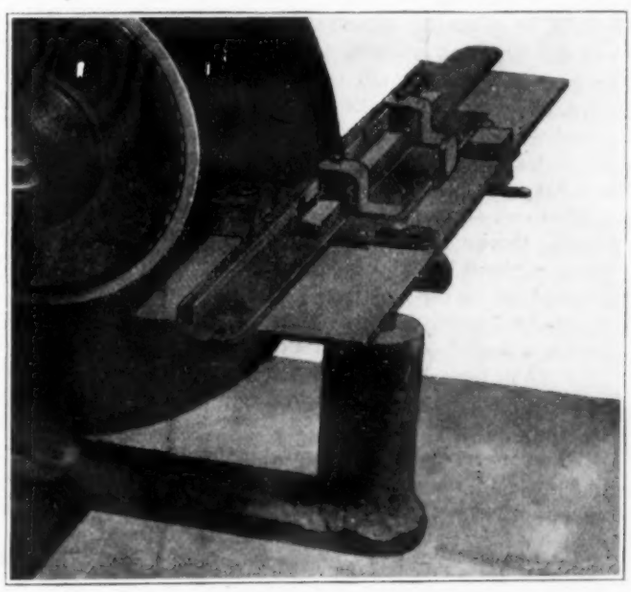


FIG. 4. A DEVICE FOR GRINDING HACKSAWS

15 to come in contact with saw 8. Parallel to this bar and in front is an adjustable guide plate 7 running lengthwise of plate 5 and slotted so as to adjust to different widths of saws.

Bar 7 also carries a tension bar 9 which is adjustable with bar 7 and which holds saw 8 in position on plate 5. Beneath plate 5 and pivoted thereto on 10 is a spring pulled lever arm 11, the outer end of which terminates in a cam shape 12. This cam works against adjustable screw 13 mounted in boss 14 projecting from base 1.

Pivotally mounted on the top cam portion 12 is a spring pulled pawl 15 inclined at such an angle to the plate 5 and saw blade 8 that the outer end of the pawl will engage and hold in one of the teeth of the saw blade next to the tooth in contact with the grinding wheel, as shown in Fig. 1.

16a is a groove in base 1 to give clearance to grinding wheel 16 so it can come in contact with saw blade 8.

The movement of plate 5 to and from the grinding wheel 16 and relative to base 1 is dependent upon the space of saw teeth per inch, as wider space requires greater travel and shorter space less travel and this is provided for in adjustment screw 17 mounted in a boss on the under side of plate 5 and on a portion which overlaps the inner face of base 1.

Movement of plate 5 toward grinding wheel 16, which movement governs the distance of the saw teeth from the grinding wheel and hence the depth of the tooth ground (irrespective of width of saw blade or of crooks) is governed by an upturned lip 18 from an adjacent plate 19 mounted adjustably on the under side of base 1. This adjustment may be regulated to suit all requirements by screw 20.

This is the means of light or hard grinding as you desire.

Adjustment screw 13 regulates the spacing of saw teeth relative to wheel 16 causing cam lever 12 to push further ahead or not, so far as is required.

Referring to Fig. 1 and Fig. 3, the operation of this device is as follows:

The base 1 is mounted in the place occupied by the toolrest in front of the grinding stand. Use a 12 in. diameter ¼ in. rubber bond alundum wheel and adjust it so the wheel comes in slot 16a in base 1. Put saw 8 in position by sliding it under tension bar 9 and let first tooth come against lip 18. Adjust lip 18 by means of screw 20 so that when plate 5 is at its most forward point the saw tooth will just fit up to wheel 16 and use screw 13 in conjunction with screw 20 in locating or positioning the saw teeth relative to grinding wheel 16.

With a diamond, dress your wheel so that it fits exactly the back, throat and face of the saw teeth. Now work plate 5 back and forth the full limit of travel allowed by lip 18 on the forward motion and screw 17 on the backward motion. If it spaces two teeth, shorten up on screw 17; if it does not space one, let out on 17. If it spaces the teeth properly in number but does not leave the teeth in proper location for wheel 16, then adjust screw 13 until it comes right.

The center of the saw up and down must be exactly in line and on a level with the center of the wheel arbor and the operator must make a full and complete stroke of plate 5 every time, or it will not space correctly. Also, pawl 15 must space directly in the throat of the tooth that comes in contact with grinding wheel 16 or it also will not space correctly. This is one of the good features of this device as it spaces directly in the throat in which the wheel works.

The speed at which this device works best is 100 to 120 strokes per minute. This seems about the most natural gait, hence the greater capacity over the other machines.

Changing a Straight-Faced Grinding Wheel to a Cup Wheel

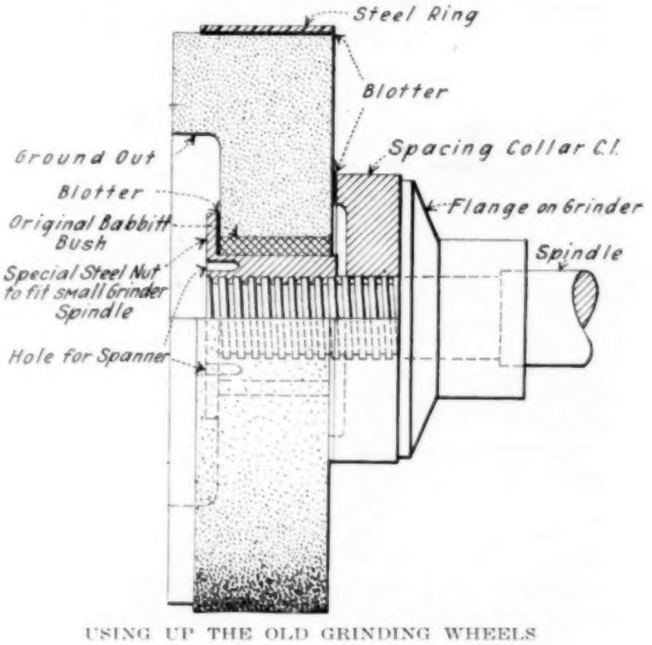
By H. H. PARKER

Several grinding wheels were on hand that had been worn down so far that they had been discarded from the grinding stand. As they had comparatively wide faces, and as a smaller grinding stand, running at a much higher speed than the larger one was available, and, furthermore, as the need for a cupped wheel often arose and none were at hand, it was determined to adapt the worn out wheels to the small stand and change them to the cupped type.

These wheels were rather "soft" and wore down fast when their diameter had been considerably decreased, so they were mounted in the lathe and "bored" out by means of old files. The faces were trued at a higher speed with the help of a special abrasive-stick wheel-dresser.

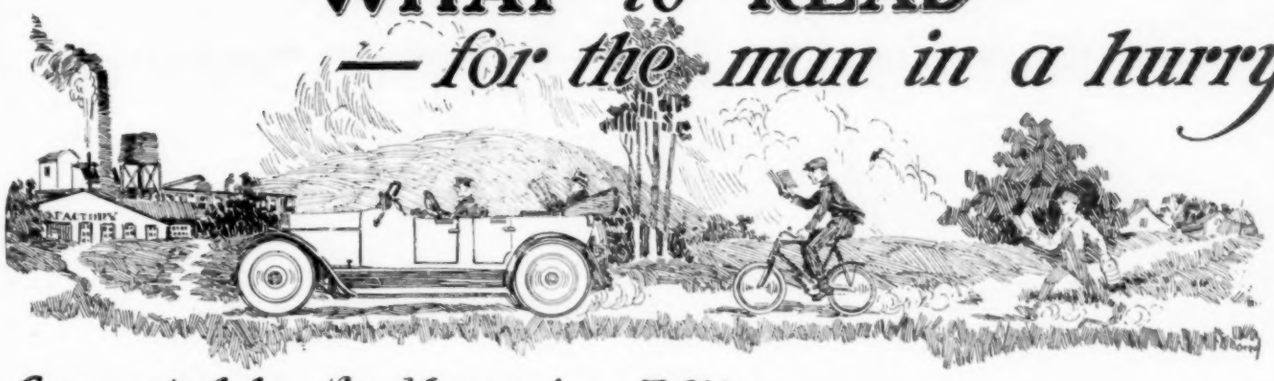
Each wheel had a babbitt bushing and this was left in place. As the small grinding machine spindle was considerably less in diameter than the larger one, there was space for a special nut between the babbitt bushing and the spindle. The nut was made, as shown in the sketch, of steel and threaded to fit the spindle. A wide but thin flange was left at the outer end to hold the wheel in place.

The regular flange was left in place next to the spindle bearing and a cast-iron spacing collar, with relieved face the same as the original flange, was placed between flange and wheel. As an extra precaution, a steel ring was driven on the wheel with a layer of blotter between; it was somewhat narrower than the wheel face so as not to interfere with the work being ground. Gaskets of blotter were also placed between both flanges and the wheel.



USING UP THE OLD GRINDING WHEELS

WHAT to READ
—for the man in a hurry



Suggested by the Managing Editor

THE magnitude of the automobile industry makes with a difficult problem in the automotive field, that of dynamic balancing. Mr. Akimoff has not a great deal to say on this subject here but what he does say is full of meat. Next we have one of John Godfrey's interviews with his old friend Johnson. This time Johnson tells how he increased production and got co-operation from his men by taking them into his confidence in the matter of manufacturing costs. Right in the middle of Godfrey's article we have inserted a boxed correction of a serious error that appeared in one of our articles in the issue of September 30. That article was a leader and we have consequently taken the best means we know of to correct our error so that it will reach the attention of everyone who saw the original article. Mistakes of this kind will creep in every once in a while no matter how many times we check a thing up but we are always ready to make the best amends we can so that the suffering of the victim of the mistake will be reduced to a minimum.

What to read was not a difficult matter to decide two hundred years ago when books were few and magazines unheard of. It is far different now when so much reading matter is offered to pass the time pleasantly or profitably as the reader chooses. We are doing our utmost to make the "American Machinist" not only profitable but indispensable as a clearing house of ideas and news of the machinery world. This page is the editors' advertisement of their section of the paper. It gives the high spots

On page 928 is the beginning of the first of three articles by Prof. H. N. Bonis of Purdue. Prof. Bonis is something of a mathematical genius and the subject of acceleration determinations which is so important to machine-tool designers is one of his hobbies. This week he discusses the "Law of Coriolis" (we never heard of this either, we are forced to admit). He tells why and how it is used and then goes on to show how simply the solution of the same problem can be worked out without using Mr. Coriolis' law.

Hunter sends us from Chicago a manufacturing article on the "Thor" Quick-Action Coupler. The work described is mostly screw machine, broaching and form milling work.

Just after Hunter's article, on page 933, we are reprinting the results of a labor turnover investigation in New York City as conducted by the Industrial Bureau of the Merchants Association of New York and published in its weekly organ. New York City is not only the financial center of the United States, it is also one of the largest manufacturing centers and consequently an analysis of labor turnover within its limits contains valuable information for employers and managers elsewhere. The conclusions of the report are significant and are startlingly similar to those arrived at by old Johnson in the story mentioned above. The secret of keeping labor turnover down seems to lie in the selection of the right kind of managers. A brief account of the machine-tool market in the newly-created country of Czecho-Slovakia appears on page 938. Although this region lies in the territory of Mr. Herzog, our Berlin correspondent, we have no hesitation in accepting the statements of Mr. Heise on the possibilities in this market. On the next page is part III of Mr. Kenyon's "Seven Centuries of Brass Making." This installment concerns itself primarily with the use of the electric furnace in the brass industry.

We have no London letter from Mr. Chubb this week but we have something just as good. On page 945 he begins an account of the milling operations on lathes in the Coventry plant of the famous British firm of Alfred Herbert, Ltd. We do not for a minute admit that Mr. Herbert's engineers or machinists know any more about running milling machines than we do on this side of the water, but it is almost always worth while to see how the other fellow does the things that we do every day, and this particular case is no exception.

Mr. Morris' current article on "Programs of Apprenticeship and Special Training" was written about the Brooklyn plant of the Sperry Gyroscope Co. and tells of short term apprenticeship or "vestibule training" for adult mechanics. An important part of the training system is the class for foremen, supervisors and inspectors. It is held twice a week. See page 951.

A short railroad shop article follows the apprenticeship article. It was written by Frank Stanley and describes methods of handling material in the Sacramento shops of the Southern Pacific. We have collected a considerable amount of railroad shop information and while we may not be able to get a railroad article into every issue there will be very few that do not contain something with an appeal for railroad shop men.

Measuring System Not a Subject For Legislative Action

THE following letter is being sent broadcast, with the idea of influencing the New York Board of Aldermen to vote an indorsement of the metric system:

WORLD METRIC STANDARDIZATION COUNCIL
Office of the Secretary
681 Market Street,
San Francisco.

November 3, 1920.

Dear Sir:

Knowing that you are an advocate of metric standardization, I believe that you will be interested to learn that this important subject has been brought to the attention of the New York Board of Aldermen, and that action will soon be taken thereon.

It is hoped that the New York Board of Aldermen may endorse the principle of metric standardization and that it will urge prompt legislation by Congress providing for a gradual transition to the decimal standards.

As you perhaps know, the Chicago City Council unanimously (66 to 0) endorsed that metric standardization movement and urged the United States Congress and British Parliament to take joint action. The great City of New York is perhaps even more vitally interested in this matter than is Chicago.

Please write to your Aldermen—and especially to the Chairman, Committee on Markets, New York Board of Aldermen, to whom this matter has been referred. Urge this committee and the entire Board to take immediate and favorable action.

(Signed) Aubrey Drury,
Executive Secretary.

AD:A

Those familiar with this form of propaganda will at once recognize the "council" as another name for Albert Herbert, the Foreign Trade Club, the World Trade Club, etc.

We wish to insist once more that such matters are not within the province of legislative bodies, the members of which, as a rule, are not familiar with manufacturing conditions.

Any action leading to changes in our measuring system, or questions of standardization, should be taken up only by committees of recognized engineers working in harmony with committees from established industrial or manufacturers associations.

Thos. Viall
Editor.

EDITORIALS

The Future of the Automobile Industry

THE magnitude of the automobile industry makes the present slackening of automobile production a serious problem for many other manufacturers. The machinery builders and toolmakers, the parts manufacturers and the tire men are almost as hard hit by the sudden shift of the car market.

Supposedly wise men have been predicting for years that the saturation point of the automobile market had been reached. And yet the demand and the production increased each year. Now this prediction is being repeated and it is well to look the situation squarely in the face to see where we really stand and what we may reasonably expect of the future.

The unprecedented demand for cars that followed the war, together with the high prices which naturally resulted, induced many new builders or assemblers of passenger cars to enter the field. This in turn stimulated the manufacturers of parts and they expanded their facilities to meet the requirements.

The present hesitation on the part of the buying public, which is in many cases merely a return to sanity and a good thing for the country, has in turn checked the demand for machine tools. Some of the newcomers in the field, as well as some of the older builders who were never strong or who have expanded too rapidly, will probably go to the wall.

But the automobile business is going to continue and this is no time to be either downhearted or pessimistic. Every high tide has its ebb, but the world goes on.

One of the reasons for pessimism is probably a lack of appreciation of the business uses of passenger cars, the employment of the common term "pleasure" car probably having much to do with this. But other industries must appreciate the growing use of passenger cars for business and must ask themselves whether they are using them as extensively as they should in their own work.

The verdict seems to be unanimous that the use of the automobile increases the efficiency of the salesman as well as of the delivery of products or materials. In districts where they can be used there is no question as to the saving accomplished. This of itself offers a large field for sales and increased production. Where time is an object (and who will admit it is not in his own business) there is a field for motor transportation.

Considering the passenger automobile from the sane point of view, we know that it is bound to stay and its use to grow until it is supplanted by something better. And its successor, whatever it may be, will require machinery and tools for its production just the same.

While the automobile plants are not likely to increase their capacity as rapidly as in the past, some of them will continue to grow to keep pace with the increasing need of cars for utilitarian purposes. Investigation shows that about sixty per cent of the mileage of passenger cars is for strictly business purposes, not including the mileage traveled when they are used in the place of steam roads or trolleys. In the farming districts this proportion of business use increases to seventy-eight per cent. Better highways will widen the field still further and stimulate the demand for cars.

Ignoring for the moment the normal increase in the number of motor cars needed in this country for 1921, the replacements alone would make a business much larger than any one dreamed possible a few years ago. Assuming the life of a car as five years, a very liberal average, we would require 1,493,617 new cars to replace those built in 1916. The following year would require over 1,740,000 cars to replace those built in 1917 and so on. Add to this the spare parts for replacements, and ample work for the automobile shops seems assured.

Looking beyond the present natural reaction from the over-stimulation of war activities, we can see no cause for discouragement regarding the future of the automobile industry. The coming of spring will see a decided reaction from the present retarded market and builders and dealers who do not have a stock of machines on hand will miss many sales. It is our best organized industry and more than almost any other stands ready to discard present equipment wherever it can be shown that it is economical to do so. Machinery builders themselves might well profit by its example in this respect.

Trucks and tractors have been purposely omitted so far, but it must be admitted that these offer a growing field and one in which economical production must be considered even more carefully than in that of the passenger car. The growth of truck use can be seen on every side. The increase from 74,000 in 1915 to 128,000 in 1917 was of course partly due to the war, but the best known builders are finding a much steadier demand than are the builders of passenger cars.

With a return to what most people consider a normal price for raw materials, prices could be adjusted on a satisfactory basis and nothing would stand in the way of immediate orders for new and improved machinery. Anything which can be done to hasten this condition will go far toward solution of the problem.

The automobile builders, relieved of the necessity of increasing production at any cost, will select their machinery more carefully than has been possible in the past few years. They will demand the machines which will insure maximum production at a minimum net cost. This means that machine tools especialy adapted for automobile manufacture will be in demand as before.

But the automobile builder, like the customer who buys his product, will demand good value for his expenditures for increased or improved equipment. This makes it advisable for machine tool builders to be sure that their own production methods and equipment are as efficient as they should be.

Now is the time for close co-operation between the two industries, the automotive and the machine tool. Now is the time for a getting together on a sound basis of mutual helpfulness and a fair profit. The automobile industry will continue to be a large user of machinery and tools and offers a wide field for new and improved machinery of many kinds.

F. H. C.

Engineering Society Action Relative to the F. A. E. S.

At the meeting of the Executive Committee of the American Institute of Mining and Metallurgical Engineers, held on Oct. 28, the following men were designated as representatives on American Engineering Council. Herbert C. Hoover, San Francisco, Cal.; J. Parke Channing, New York, N. Y.; Arthur S. Dwight, New York, N. Y., Edwin Ludlow, New York, N. Y.; Allen H. Rogers, Boston, Mass.; Philip N. Moore; J. V. W. Reynders; Joseph W. Richards, Bethlehem, Pa.

At its regular meeting on Oct. 25 the Grand Rapids Engineering Society adopted resolutions accepting the invitation to become a charter member of the Federated American Engineering Societies and has pledged its "hearty co-operation and assistance in the work undertaken by the federation and is confident that the work as outlined by the purposes and aims of the federation will have a very beneficial and far reaching influence."

The advisory Council of the Iowa Engineering Society at its regular meeting on October 20 voted unanimously to recommend to the Iowa Engineering Society at its annual meeting that the society apply for membership in the Federated American Engineering Societies and designated Professor J. H. Dunlap as its representative to the meeting of American Engineering Council in Washington, Nov. 18-19.

The joining of the societies named raises the total of member-societies, which will be represented at the meeting of American Engineering Council in Washington Nov. 18, 19 and 20, to eighteen. A list of the member-societies follows:

American Society of Mechanical Engineers
American Institute of Electrical Engineers
Technical Club of Dallas
Cleveland Engineering Society
Engineering Association of Nashville
American Institute of Chemical Engineers
Engineering Society of Buffalo
American Institute of Mining and Metallurgical Engineers
Society of Industrial Engineers
Kansas Engineering Society
Alabama Technical Council
American Society of Agricultural Engineers
Detroit Engineering Society
Florida Engineering Society (subject to ratification in February)
Engineering Society of York
Washington, D. C., Society of Engineers
Grand Rapids Engineering Society
Iowa Engineering Society (subject to ratification at annual meeting).

Dimensions of Keyways

By Taro Kuraisi

Tokio, Japan

I was very much interested in the article "Dimensioning of Keyways," by Hans Ernst, published on page 82 of the *American Machinist*. It was presented from the drafting viewpoint. I wish to present it from the broaching viewpoint.

In the broaching process it is necessary to know the value of L, Fig. 1, when we want to know whether or not the broach and broaching mandrel are of the correct sizes for the job. We measure the thickness of broach A and the thickness of mandrel B. The sum should equal L. The difficult part of the calculation to find L is

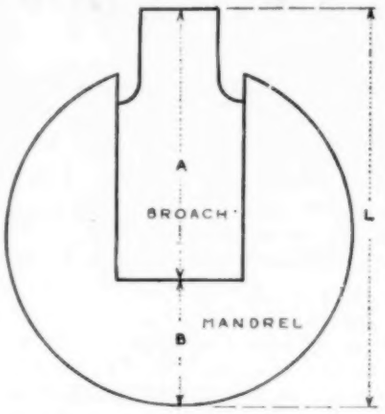


FIG. 1. MANDREL AND BROACH FOR BROACHING KEYWAY

that by which we find the value of F, Fig. 2, and I have made the chart, Fig. 3, to obviate the necessity of making such calculation. This chart shows the values of F for bores up to 8 in. in diameter and widths of keys up to 2 in. L is found from the following simple formula: $L = D + d - F$.

The method of using the chart is easily explained by an example. Assume the diameter of bore is 5 in. and the width of key $\frac{3}{4}$ in. Find, on the chart, the intersection A of the vertical line at 5 in. with the horizontal line at $\frac{3}{4}$ in. width of key. We see that A is between 8 and 9 deg. On the left-hand side of the chart find the point B, on the horizontal line from $\frac{3}{4}$ in. width of key at a corresponding position between 8 and 9 deg. A vertical line dropped from the point B shows the value of F, in this case 0.028 in.

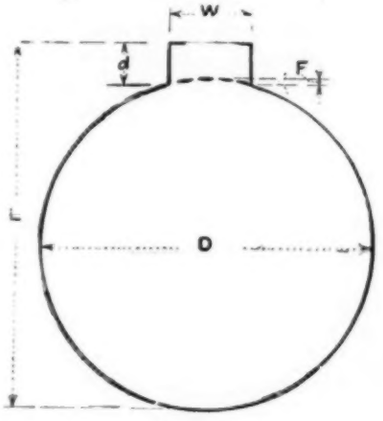


FIG. 2. (UPPER) DIAGRAM REPRESENTING BORE AND KEYWAY

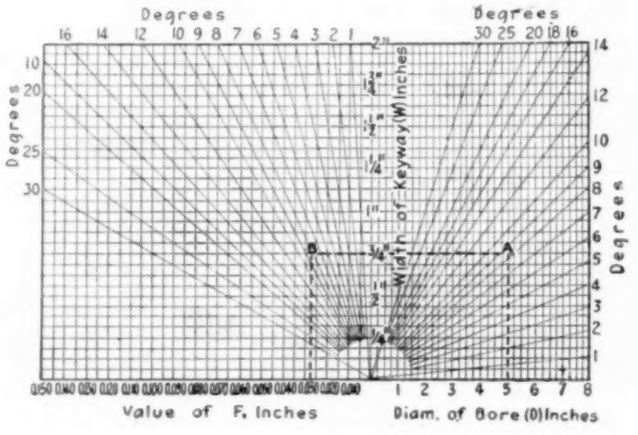


FIG. 3. (LOWER) CHART FOR DETERMINING THE VALUE OF F (FIG. 2) FOR KEYWAYS

SHOP EQUIPMENT NEWS

- Edited By -
S. A. HAND

SHOP EQUIPMENT • NEWS •
A weekly review of modern designs and equipment

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

• CONDENSED • CLIPPING INDEX
A continuous record of modern designs and equipment

Pangborn Rotary-Table Sandblasts

The Pangborn Corporation, Hagerstown, Md., has placed on the market the rotary-table sandblasting machines herein described, some of them being developed from older models of machines made by the same concern. The table is rotated by power, so that the work passes beneath the nozzles. The nozzles are automatically oscillated, so that the blast reaches all portions of the blasting zone, which is completely inclosed. It is claimed that the output is large because of the continuous operation, that the labor requirements are small and that the operator is removed from contact with flying abrasive.

For work difficult to clean or of large size the direct-pressure system is used. In Fig. 1 is shown such a machine equipped with an elevator and a separator using both mechanical means and circulation of air for reclamation and separation of the abrasive for re-use. The reclaimed abrasive is accumulated in storage bins, from which the tank for the blast can be quickly refilled by operating a valve, thus making the operation of the machine practically continuous. The machine is made in two sizes, with table diameters of 70 and 90 in. and a clearance of 15 in. between the table top and the nozzles.

The gravity-feed type of machine, shown in Fig. 2, is intended for work less difficult to clean or where the intensive action of the direct-pressure blast is unnecessary. The machine is self-contained. Both mechanical and draft action are used for reclamation and handling of the abrasive, which is fed by gravity in a continuous cycle to the nozzles. The machine is made in but one size with a table diameter of 84 in., and it has an adjustment of the nozzle arms that permits a clearance of either 10 or 15 in. between the table top and the nozzles.

The self-contained suction-feed machine, shown in Fig. 3, is intended for the cleaning of light work and refinishing. The used abrasive is reclaimed through screens and handled without the use of an elevator. The cleaned abrasive is carried continuously by suction to the nozzles. The machine is made in two sizes, the one shown in Fig. 3 having a table 42 in. in diameter and

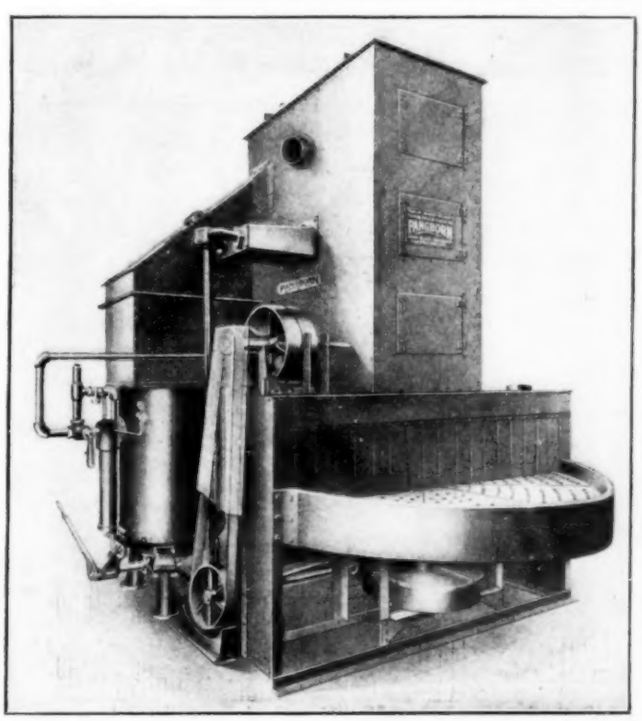


FIG. 1. PANGBORN DIRECT-PRESSURE ROTARY-TABLE SANDBLAST

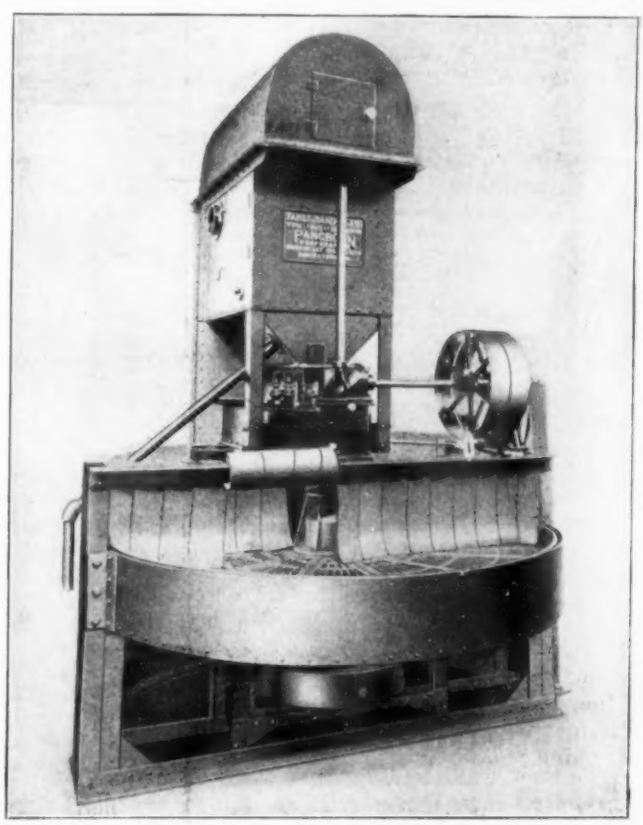


FIG. 2. PANGBORN GRAVITY-FEED ROTARY-TABLE SANDBLAST

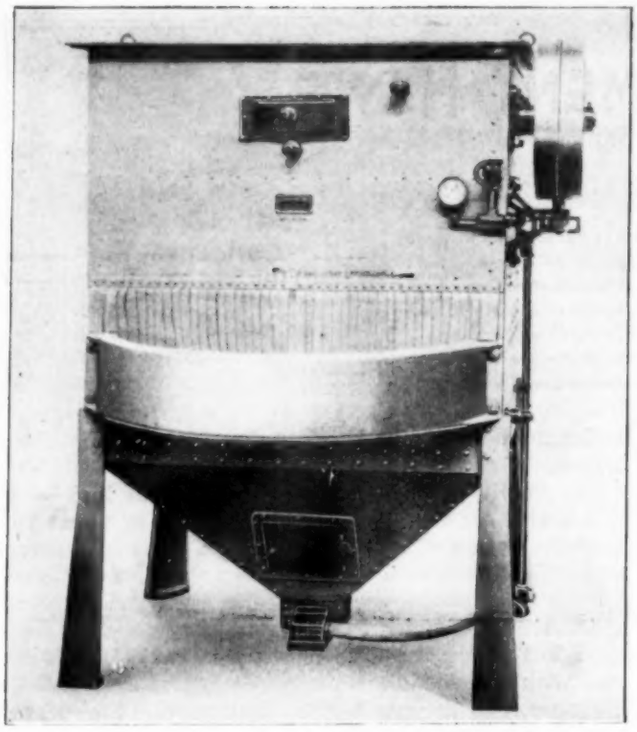


FIG. 3. PANGBORN SUCTION-FEED, SANDBLAST WITH 42-IN. ROTARY TABLE

one nozzle with a vertical adjustment allowing any distance from 5 to 12 in. between the table top and the nozzle.

The larger size of suction-feed machine is shown in

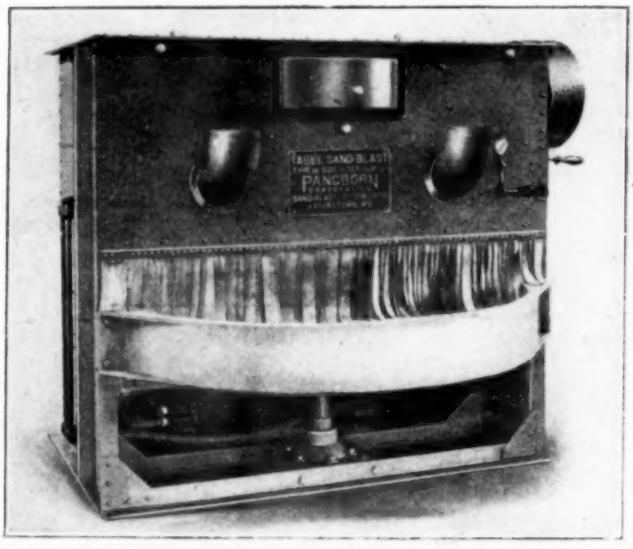


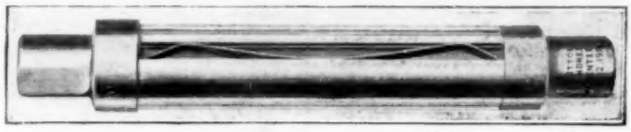
FIG. 4. PANGBORN SUCTION-FEED, SANDBLAST WITH 70-IN. ROTARY TABLE

Fig. 4. It has a table diameter of 70 in. with a clearance of 12 in. between the nozzles and table top, allowing the handling of reasonably large work or a large quantity of small pieces.

Ettco Self-Gripping Mandrel

The Eastern Tube and Tool Co., Inc., Brooklyn, N. Y., has placed upon the market the self-gripping mandrel shown in the illustration. It is intended to hold bushings, gears and similar parts while turning or grinding, the parts being slipped on or off the mandrel by turning them slightly to the left.

The body of the mandrel is made of alloy steel and has three grooves, each of which contains a roller made of hardened drill rod and held in the proper position for gripping by means of flat springs. The collars at each end retain the rollers and springs. When the cut



ETTCO SELF-GRIPPING MANDREL

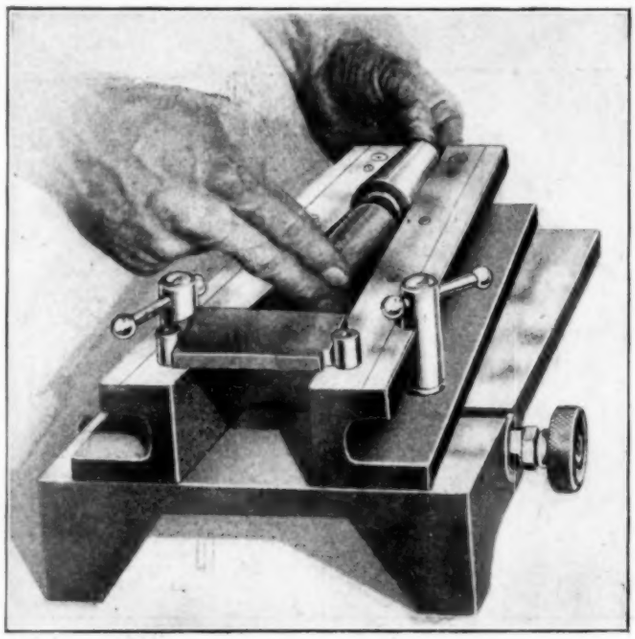
is applied to the work on the mandrel the rollers are caused to wedge and grip the work rigidly. It is said that no driving is necessary when putting on or removing work and that the presence of oil and dirt does not interfere with the action.

The body of the mandrel is ground 0.0002 in. undersize. Due to the action of the rollers, the mandrel will grip work 0.005 to 0.015 oversize. The mandrel is made in a range of sizes from ¼ to 2 inches.

Doyle-Wall "Precision" Taper-Measuring Gage

The Doyle-Wall Machine & Tool Co., 318-24 Pearl St., Syracuse, N. Y., make the precision taper-measuring gage shown in the illustration. The device consists of a double sine bar and angle-measuring gage, being intended for use either in originating or duplicating tapers. It is composed of steel parallels mounted on angle-bars, which are each pivoted at one end on pins set in the baseplate. The other ends of the bars are moved simultaneously by means of an adjusting screw, the bars being secured in position by locknuts when the desired taper has been established.

When setting the gage reference is made to a chart, which gives the distance required between the measuring pins in order to obtain the desired angle. Either precision gage blocks are placed between the pins to



DOYLE-WALL "PRECISION" TAPER-MEASURING GAGE

obtain this distance, or a micrometer is used over them, the gage being adjusted by turning the knurled nut until the proper distance is obtained. Tapers from 0 to 4 in. per ft. can be measured. A chart, figured to four points of decimals, is supplied with each gage to show the values of tapers from $\frac{1}{16}$ to 4 in. per foot.

It is claimed that the gage can be set up much more quickly than a sine bar, that it accurately measures as many pieces as desired after being set, and that no high degree of skill is required for its operation, because only one measurement is necessary. The parallels and pins are hardened, ground and lapped, an accuracy to within 0.0001 in. being guaranteed. The tool is regularly made in two sizes with 12 or 6 in. centers, but gages for any desired size of taper can be furnished.

Self-Locking Hub Plate

The self-locking hub plate shown in the accompanying illustration has been designed to replace the methods of putting in hub liners which are now in use. This does away with the method of casting the hub plate into the driving box and also of fastening it in by screws or similar methods.

The driving box is bored with an undercut recess, similar to that used for casting liners in place, excepting, as will be seen in Fig. 1, the box is offset as shown at *C* and *D* so as to make it slightly eccentric with the bore for the outside of the crown brass. The hub plate is made in two parts *A* and *B*, as in Fig. 2, with a dovetail on one side to fit the recess in the box.

After the machining work is completed it is only necessary to slip the two halves of the hub plate in position and then force in the crown brass *E* in the usual manner. The outer end of the crown brass acts as a key and locks the two parts of the hub plate firmly in place. The fact that the outer edge of the hub plate is eccentric with the outer edge of the crown brass effectually prevents the hub plate working out of position.

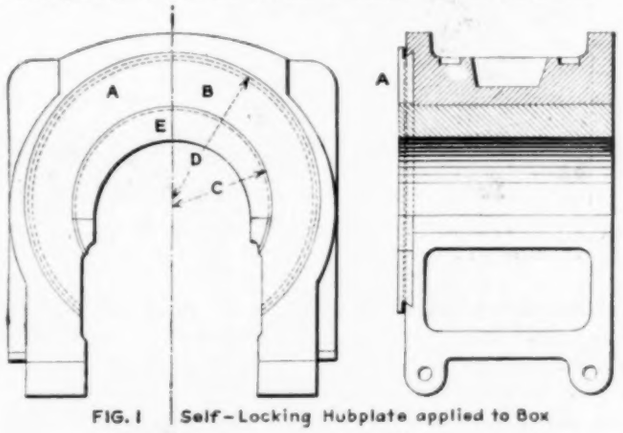


FIG. 1 Self-Locking Hubplate applied to Box

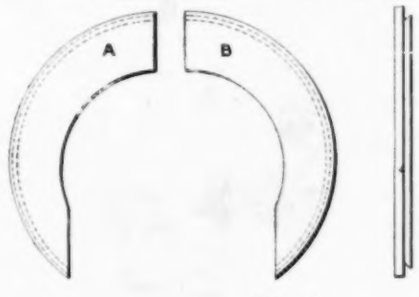


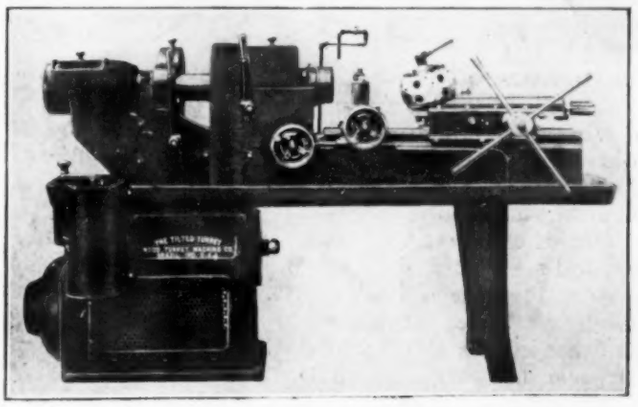
FIG. 2

FIG. 1. SELF-LOCKING HUB PLATE APPLIED TO BOX
FIG. 2. HOW THE PLATE IS MADE

These hub plates are in use on about forty locomotives of a well-known railroad and are giving satisfactory service at a considerably lower cost than the plates formerly used. They are being marketed by J. P. Finerty & Co., Dunmore, Pa.

Motor Drive for Wood Turret Lathe

The Wood Turret Machine Co., Brazil, Ind., has recently brought out the design of motor base and belt drive shown in the illustration for use on its tilted-turret lathes and screw machines. The motor base or cabinet leg is so arranged that the motor may be easily



WOOD TURRET LATHE WITH DRIVING MOTOR MOUNTED IN BASE

removed for cleaning or repair by the loosening of three screws which hold the circular lid at the end of the base.

Power is transmitted from the motor to the large driving pulley on the spindle by means of a double belt passing through the pan and tightened by a double-acting idler, which is controlled by the hand lever shown at the right-hand side of the base. The belt is guarded by means of a cast-iron cover.

This motor-drive arrangement is being supplied on the Nos. 2, 3 and 4 back-geared type of machine, d.c. variable-speed motors being used. The controller-box crank, as well as all operating levers, are so grouped that they are within easy reach of the operator, without necessitating his changing of position.

Speeding Up Machine Tools With Compressed Air

BY F. A. MCLEAN

Quantity production on an efficient basis is often dependent on the facilities provided for handling the product during the course of manufacture, and in order that maximum production be maintained it is necessary to make the physical requirements called for on the part of the operator as light as possible. When this is done a workman should be able to accomplish practically the same amount of work toward the close of the day as in the beginning. It this is not done, no matter how strong the man may be, he is bound to feel the strain from his continual exertion and his efficiency and value to his employer is lowered as the day advances.

Any arrangement which will minimize this fatigue on the part of the worker, is worthy of attention from the standpoint of higher efficiency, as the conservation of physical energy, so often spent in non-productive labor, is of primary importance. Aside from the process of

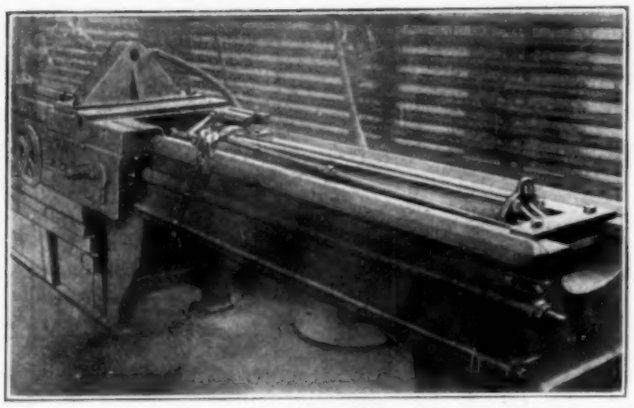


FIG. 1. AIR-HOIST CYLINDER APPLIED TO LATHES FOR RAPID TRAVERSE OF CARRIAGE

moving the work to and from the machine, the operation of the latter generally calls for considerable exertion on the part of the worker, especially in the case of heavy machine tools.

One of the most flagrant offenders in this respect is the ordinary lathe, especially in the larger sizes which require the expenditure of considerable energy in running back the carriage after a cut has been made. In the case of quantity production, this often consumes a large amount of time and labor which could be more profitably applied in other ways. Many of the more progressive manufacturers who realized this fact have applied a direct lift air hoist cylinder to the task with a view to relieving the operator and speeding up the output from the tool. During the war, devices of this nature were quite a common sight in the large munition plants of the United States and Canada, but with the close of the shell contracts, many of these contrivances have gone to the scrap heap, which is unfortunate, as many shops could apply them to the manufacture of their regular products with excellent results.

An arrangement of this kind applied to a 24-in. x 20-ft. lathe used for drilling holes in submarine drill pistons in the plant of the Canadian Ingersoll-Rand Co., Limited, Sherbrooke, Quebec, is shown in Fig. 1. From an examination of the illustration it will be seen that the air hoist cylinder which is 3 in. in diameter by 4 ft. long is placed between the shears of the lathe and supported at each end by rectangular pieces of iron which are clamped to the lathe bed by four bolts. A hole is bored in the lower part of the lathe carriage into which is fitted the end of the hoist piston-rod from which the hook has been removed. This arrangement allows the cylinder to be moved to the most convenient point on the bed or even removed altogether and applied to another machine in a few minutes if desired.

The hoist cylinder is of the double acting type and is controlled by a very simple three-way valve located within convenient reach of the operator. Pushing the handle of this valve to the left causes the carriage to travel toward the headstock and vice versa, while moving it to a central position cuts off the air supply and allows the air in the cylinder to exhaust. A globe valve is placed between this three-way valve and the supply hose to take the strain off the three-way valve when the device is not in use.

Some of the more modern multiple-spindle drilling machines are provided with means for raising as well as lowering the head by power, but in many shops there are machines in use which do not have this feature, and when the machines are of large size it is very tiresome for the operator to have to raise the heads by hand. A simple way of using compressed air to do this work is illustrated in Fig. 2 and consists of a small double-acting direct lift hoist attached to the top of the machine by a cast-iron bracket. The lower end of the piston rod is screwed into a hole bored in the top of the saddle or head of the machine. Supply pipes run from the upper and lower ends of the hoist cylinder are bent to conform to the contour of the machine and terminate in an adjustible valve located near the belt and feed controls of the drill. With a drilling machine fitted up in this way it is possible for an apprentice boy to turn out a larger volume of work than a fully grown man could when moving the drill head by hand.

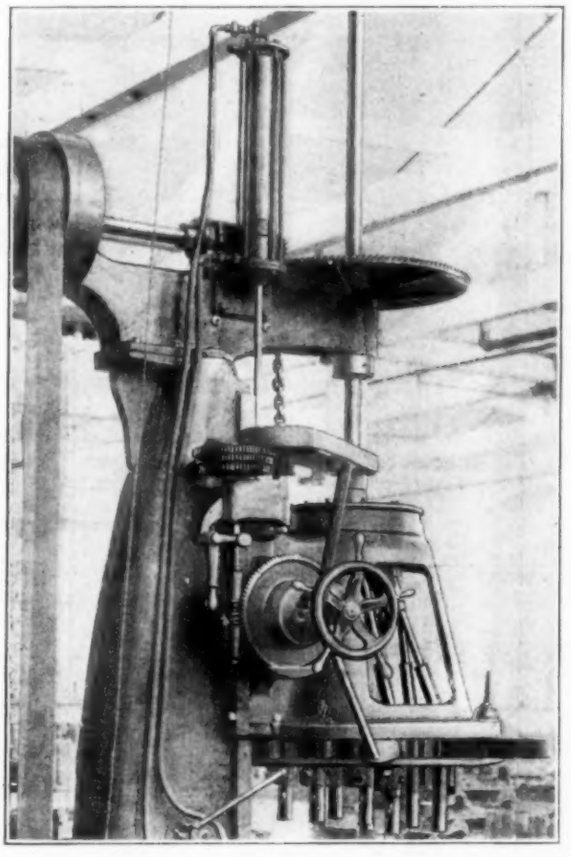


FIG. 2. AIR-HOIST CYLINDER APPLIED TO MULTI-SPINDLE DRILLING MACHINE FOR RAISING AND LOWERING THE HEAD

There are other ways of using air hoist cylinders in connection with machine tools whenever a horizontal or vertical reciprocating motion is required. The number and value of possible applications of this kind will vary with the size of the shop, type of equipment in use, and the nature of the product manufactured.

Weighing Automobile Parts To Determine Amount of Wear

Some rather interesting work has been undertaken for the Motor Transport Corps in connection with its experiments on the deterioration of automobile parts in service. A number of bearings and gears have been accurately weighed on the bureau's balances and have been placed in cars in service. After a certain length of time these parts will be returned to the bureau and reweighed, the difference in weight representing, of course, the loss in metal due to wear.

Fortieth Anniversary Meeting of A. S. M. E.

SEVERAL noteworthy addresses marked the fortieth anniversary meeting of the A. S. M. E., held at the Engineering Societies Building on the evening of Nov. 5. "The Opportunity and Responsibility of the Engineer" was the subject of the evening. Henry R. Towne, the oldest living past president of the A. S. M. E., was the first speaker. In his review of the early history of the society he related that at the October meeting of 1883 the attendance, out of a total of about 600 members, was 150. For the year 1883 the income of the society was $7.560, which looks small indeed compared to the proposed budget of $500,000 for the coming year. Mr. Towne also discussed a paper which he had presented at a Chicago meeting of the society in 1886, entitled "The Engineer as an Economist."

The American Society of Civil Engineers was represented by A. P. Davis, its president, who, after congratulating the A. S. M. E. on its growth and the scope of its activities, expressed the hope that the A. S. C. E. would join the Federated American Engineering Societies.

W. L. Saunders, past president of the American Institute of Mining and Metallurgical Engineers, expressed the opinion that the profession of mechanical engineering is a basic one and is of great importance because men of the other branches of engineering must have a knowledge of it as a basis.

Past-president Scott of the A. I. E. E., by an illustrated talk, showed that engineering progress has been extremely rapid, with the creation of great forces and that the engineer now has the responsibility of controlling and operating these forces. Mr. Scott's statement, "The modern engineer is a director of human activities as well as of inanimate operations," gained applause.

J. Herbert Case, acting governor of the Federal Reserve Bank of New York, pointed out that three directors of the Federal Reserve Bank of New York were drawn from the membership of the American Society of Mechanical Engineers. He called the attention of his hearers to the fact that the constitution of the Federated American Engineering Societies defines engineering as "the science of controlling the forces and of utilizing the materials of nature for the benefit of man." He then went on to develop his ideas that bankers have essentially the same problems before them as engineers; he referred to bankers as financial engineers and said that they are now coming to use essentially engineering methods. He felt strongly that the recent period of inflation, which we are apparently passing in safety, might have developed into a very serious crisis had it not been for the preparations made by bankers to meet just such a contingency. These preparations consisted principally in the establishment of the Federal Reserve system, by which one-third of the number of banks in the country, representing two-thirds of our banking resources, have practically pooled their resources to the end that individual failures may be averted. This action Mr. Case compared to the allowance made by engineers for a "factor of safety"; the idea being, in both cases, to provide beforehand whatever strength will be needed to cope with any emergency that may arise. The speaker suggested that it is not unreasonable to suppose that as a result of improved financial methods we have probably seen our last general panic. "But," he continued, "I look further ahead than that. As engineers are never satisfied with the machines they have created, but continually work and strive to improve upon them, so bankers will finally improve their methods to such a point that they can avoid not only catastrophies such as panics, but even the minor crises and financial disturbances which trouble us so greatly today."

Gompers Invites Co-operation

Samuel Gompers, president of the American Federation of Labor, was the next speaker. The keynote of his address was to the effect that "One of the difficulties that arise nowadays about our discussion of responsibility is that we fail to realize that professional men, whether doctors, lawyers or engineers, should be in a very real sense agents of society and not merely masters in their particular professions." He thought it unnecessary to review the achievements of engineers in mechanical ways, but declared that a very serious error is frequently made in describing manufactured articles as the product of an industry. It is not the inanimate objects produced in the factory that count; it is the men developed there. In other words, "men, not things, are the true goal of civilization." In a realization of this fact lies the engineer's opportunity to develop co-operation between capital and labor. There is a great future ahead for both capital and labor if they will join hands with engineers and make an effort to improve the conditions of labor, to give the workman a chance for self-expression in his daily work and to relieve the deadly monotony of repetition work, which is the principal cause of labor troubles. In our mad rush for efficiency we have allowed the man to become too greatly a part of the machine. The old spirit of craftsmanship has gone, so that men's work today tends to become mere toil. Mr. Gompers drove home his point with this vivid warning: "Beware that the machines you create do not become a Frankenstein and enslave the human race." The avoidance of this danger is a part of the coming responsibility of the engineer. In conclusion Mr. Gompers said: "If you will study the laws of humanity with the same degree of intensity that you study the laws of material science you will render a tremendous service, and as president of the American Federation of Labor it is my firm conviction that the labor movement not only welcomes but invites your co-operation."

Dickson on Economic Autocracy

The next speaker was William B. Dickson, the vice-president of the Midvale Steel and Ordnance Co. Mr. Dickson's address was remarkable for the fact that he so frankly and so whole-heartedly espoused the cause of the workingman. In fact, he was hardly less emphatic than Mr. Gompers himself. For this reason his speech may be said to have been the feature of the evening. Mr. Dickson expressed the same thought which had just previously been spoken by Mr. Gompers; namely, that our modern system of the division of labor, consisting in the assignment of a highly specialized task to each individual workman, has deprived men of the joy which

they once secured through the exercise of creative instinct in their work. The result of this condition, he said, will tend to stunt men mentally, morally and physically, unless it is counteracted by some other vital force. It cannot be met by reverting to original and obsolete methods; our factories must continue to produce efficiently, but not at such a sacrifice of individuality. "This is a human problem," said Mr. Dickson, "and I have not been able to solve it, so I am leaving it to you."

"It has been said," he continued, "that free government is more important than good government. I believe that this is substantially true; and I would say that if there must be a choice it is better to be free and inefficient than to secure efficiency by having men become mere cogs in a complex social machine, operated by a so-called superior class. I am afraid that we are making a fetish of efficiency." There is, however, another broader and more important question than this; it is the great issue between democracy and autocracy. We have been accustomed to consider that this question was solved in 1776, as indeed it was, politically; but in industry the present tendency is to revert to the feudal system of despotism. This has been exemplified in the past few months by restriction of production, and even the closing down of plants, with the object of holding prices up. An example that is still fresh in our memory is that of the large textile mills which were shut down completely, resulting in great suffering to the entire community. It is this "unconscious insolence of conscious power" which is at the root of our industrial difficulties. "Consider, for a moment," said Mr. Dickson, "the despotic power which our modern system of industry gives a few men over the lives and fortunes of thousands of their fellow citizens. By reason of this condition we have the unstable situation of a government founded on the suffrages of men who, for all practical purposes, are industrially bondsmen." We are approaching the time when we shall need an industrial Lincoln to say: "A house divided against itself cannot stand; this nation cannot continue to exist politically democratic but economically autocratic." The appreciation of the audience at this point resulted in a round of applause in which Mr. Gompers took a leading part.

In Favor of a Fair System of Collective Bargaining

Mr. Dickson declared himself in favor of a fair system of collective bargaining and of giving workmen some share in the conduct of business, probably through applying a portion of their wages to the purchase of stock in the company. These systems, of course, must be designed to meet the needs of the particular plants which are to use them; and unless they are permeated with democratic principles there can be no solution of our labor troubles. Some people may claim, however, that they are satisfied with present conditions and do not desire a change. This is only an evasion of the issue. The choice does not lie between industrial democracy and the present way of doing things; it lies between industrial democracy and a condition of chaos and feudalism such as we see in Russia today.

The speaker offered two suggestions to meet the situation. First, he said that we should democratize industry, giving recognition to management and labor as equal partners with capital; and second, we should teach democracy in the schools as thoroughly as we now teach reading, writing and arithmetic, so that the coming generation will be thoroughly grounded in democratic principles.

"I am not looking forward," concluded Mr. Dickson, "to the new era of industrial democracy as a period of peace and serenity, but rather as a time in which the way has been cleared for a further toilsome climb up the spiral of evolution."

Between the speeches President Miller read a number of congratulatory telegrams, notably those from Herbert Hoover, E. S. Carman, the president-elect of the society, Governor Coolidge and Senator Harding.

An Inexpensive Blueprint Machine

By H. W. Armstrong

The average small shop if run on an up-to-date plan requires a large number of blueprints. The old method of enclosing tracing and blueprint paper in a frame and exposing to the sun is slow and many times it is not possible to obtain prints because of lack of sunlight. When prints are needed in a hurry it means delay and inconvenience and sometimes a copy of the tracing has to be made.

Most blueprinting machines are too expensive for the small shop. In our shop we made a small machine, shown in Fig. 1, using three electric light bulbs. This machine did good work, although it was slow, and had the advantage of being independent of the sun. However, as we required more prints than the capacity of this machine provided, we finally adopted the set-up shown in Fig. 2. To the writer's knowledge there is only one other in use for this purpose.

We purchased a Cooper-Hewitt mercury bar lamp similar to those in use in photo-galleries and of the following specifications: F Lamp; Type QJ; Spec. 901; 60 Cycles; 103 to 118 Volts; 6 to 7 Amperes.

This was fastened to the wall and a frame built around it. A blueprint frame was also made, large enough to hold our largest tracing, and when in use was placed on the projecting shelf parallel to the lamp and about 12 in. away from it.

The machine, frame and complete set-up, cost about $100, and the work is very rapid and satisfactory as the mercury light is very much like sunlight and the prints produced are equal to any made in the sun. The time of exposure should be about three minutes.

The machine is perfectly satisfactory and has the advantage of low initial cost and low upkeep. The tubes last a long time and can be replaced at small expense. The light is also very easy on the eyes.

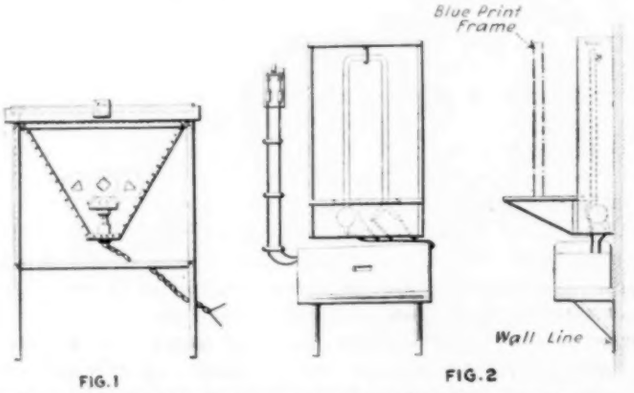


FIG. 1. PRINTING MACHINE WITH INCANDESCENT BULBS
FIG. 2. SET-UP USED IN CONJUNCTION WITH COOPER-HEWITT LAMP

Nineteenth Annual Fall Convention of the National Machine Tool Builders' Ass'n

PRESIDENT NEWTON opened the fall convention of the National Machine Tool Builders' Association Thursday morning, Nov. 11, at the Hotel Astor, New York. His brief address dealt with the present period of depression in the machine-tool business and presented conclusions to the effect that the machine-tool builders must face the existing depression as they cannot stop the downward trend of business. Demand is beyond their control and price reductions would not create reassurance even if they could be given. It is recognized that they cannot be given for several reasons. During the last five years prices have not increased in proportion to the costs of materials and labor and the burden of the cost of experiments and improvements has increased. There could be only one cause to justify a reduction in prices, namely, a reduced cost in materials, and reduced selling prices on such an account are very improbable because the increased cost of overhead due to the limited output will offset any reduction in material costs that may take place.

In regard to cancellations, Mr. Newton said that he hopes the machine-tool builders will take steps to raise orders for machine tools to the dignity of real contracts. He also advised preservation of resources, that is, cash.

The routine business of reports of officers and committee reports was dispatched quickly. An interesting committee report was that of Mr. Bullard showing good progress on the export catalog which will probably be ready for distribution during the spring of 1921. Translations are being made into French, Spanish and German. Foreign dealers are glad that the American manufacturers are going in for advertising in foreign fields.

AUGUST H. TUECHTER, PRESIDENT

Standardization of Electric Equipment

D. R. Weedon of the Westinghouse Electric and Manufacturing Co., delivered a lantern-slide talk on "Standardization." He interpreted standardization to refer to methods of application rather than to the motors themselves. The high spots of his talk were to the effect that the motor manufacturer should be called upon to work out the best way of applying the motor during the design of the machine, not after it is built. The selection of a motor depends upon the kind of tool with which it is used, the method of application, type of control and load factor. Among the kinds named were constant-speed for such tools as screw machines; adjustable speed for planing machines, milling machines, lathes and drilling machines; variable speed for fans and pumps; high starting torque for drilling machines, lathes and light tools; high pull-out torque for grinding machines and others where the strain on the motor is heavy; and high frequency for wood-working machines. Slides were shown picturing belted motor drive, direct drive, motor in base of machine, motor built into the machine and other arrangements. Protection from dirt and economy in space, bearings, shafting and belting were mentioned as advantages of motor drive. Automatic and manual controls were shown and their possibilities explained. The importance of overload relays and low voltage release were emphasized. Builders were advised to design their units to make possible the application of motors of at least two manufacturers to prevent being delayed by limited production in one motor manufacturer's plant.

Frank H. Foster spoke on "Machine Shop Conditions in China." He said that American tools are liked and that American manufacturers have a good chance to get their machines introduced and disposed of.

The afternoon session was devoted to addresses and discussion of financial conditions and cancellation of orders. Francis H. Sisson, vice-president of the Guaranty Trust Co., New York City, spoke on "Financial Conditions as Affecting Business." The following several paragraphs give a summary of his address:

It is probable that now, more than ever before, there exists in business a condition of doubt and little clarity of thought. The business interests of the banker and of the machine-tool manufacturer are to a great extent the same, the banker's great problem being that of credit.

Today we are filling the gaps which the war created and are suffering because of the inflation by which the war was financed and which depreciated the dollar. The United States in 1914 financed the allies indirectly in many ways, extended banking credits and floated foreign securities. Beginning in 1917 the world put $337,000,000,000 into the war and diverted 40,000,000 lives from production to wasteful industry, and lost 10,000,000 lives. Money put into war is wasted and

the National debt is increased, in this instance by $23,000,000,000. For such conditions we are now paying. Bankers have been accused of refusing credit to legitimate business, but the contrary is true as banks have gone the limit in extending credits. Interest prices have not increased in proportion to other rises and money is the cheapest commodity we have. Credit is not an artificial product of banks or government. It is a medium of exchange and represents a transfer of property. Wealth can be created only by human effort. Present German and Russian conditions are the result of trying to create credit by the use of the printing press.

Banks Not Profiteering

The Federal Reserve has loaned up to the limit of the reserve provided by law for the past five years. Since 1914 production and distribution have increased 20 per cent and prices 100 per cent, which means that 120 per cent more capital has been required to handle business, this quantity representing more than 10 per cent of our national income. More than twice the amount of money required in 1914 was required to finance the business of 1919. The banks have not been profiteering and talk to that effect and loose thinking are hazardous to business. What is needed to improve conditions is co-operation between business and banks and a realization of the unity of their interests. Money is sold as is any other commodity, the price being controlled by supply and demand. No control is exercised by the banks; when money is scarce rates are up and when it is plentiful they are down. Rates for call loans, compared to the value that money holds, are so low that it is wrong to indict the banks for high rates. Money scarcity must be offset by thrift and production.

United States Faces a Prosperous Era

The United States stands today very much as did England at the close of the Napoleonic wars. We are the only nation on a sound financial basis and we have health, organizing ability, intelligence and natural resources. World markets and opportunities await our taking and we must put our house in order and commence to take advantage of conditions. We must have an understanding of foreign markets, must send our overproduction to them and must help finance foreign nations. If we follow our opportunities we may have an even greater success than England has had. Foreign trade is no dream, but cold, hard necessity and it represents high service as well as profits. No nation lives for itself alone any more than does an individual and we as well as others are affected by the sore spots of the earth.

Cancellation—or repudiation—of orders by the United States and by foreign merchants causes a deplorable situation. There must be a cure for the breaking down of morale which causes men to repudiate their just committments, otherwise we are going to suffer as other nations have suffered. We must not lend ourselves to such practice as it puts us in a bad light.

As regards the immediate future there is no relief in sight, at any rate not until the first of the year, when conditions will ease off slightly. Until labor is liquidated as well as commodities, until we have filled up gaps caused by the war and until all inflation and profiteering have been antidoted, we will not reach normal. All that goes up must come down. We ought to be glad that the reaction has come as it means that we are getting back to a normal condition. We accumulated a surplus during the war, have at present good crops and a good banking system and are beginning to understand interrelations, so that we face a prosperous era. Our best policy is to stick to old-fashioned guides such as the ten commandments and copybook rules.

During the discussion the opinion was brought out that nothing less than the rehabilitation of Europe can correct the exchange evil and that so long as the European countries continue to print money as they have been doing, such money will stay low in value in comparison to the dollar.

The Legal Viewpoint of Cancellations

"Cancellation of Orders" was the title of an address by W. Randolph Montgomery, counsel, National Association of Credit Men, New York City. He presented the subject from the legal viewpoint, bringing out the point that it is easy to set up moral standards when the market is advancing, but another matter to maintain them on a falling market. Buyers have been speculating on continuous buying and the public has struck, leaving the buyers the choice of standing a loss themselves or cancelling orders. They have had the privilege of cancellation for a year or more because of the easy resale of cancelled goods and when the drop came with a possible curtailment of this privilege they began to examine their contracts and in many cases found that they were not binding. Such statements as "order not subject to cancellation," and "all claims for defective goods must be made within ten days of their receipt," printed on bill heads and packing slips, are worthless. The Uniform Sales Act is a business man's statute, which has been adopted in more than twenty American States and in England and it would pay every business man to have a copy of the act in his library.

Cancellations cannot be prevented. The law gives opportunity for redress, sometimes for price and sometimes for damages. To make enforcement of contracts good the buyer must be able to pay when judgment is brought against him, which significant point must not be overlooked when considering suit.

Four things will help minimize cancellations: (1) Make it less easy to cancel by making contracts legally enforcible, (2) let it be known among competitors that certain houses are given to cancelling orders, (3) insist more often upon legal right to damages for breach of contract, and (4) carry on a campaign of education against reckless buying and in favor of a higher standard of ethics.

E. W. McCullough, manager of the Fabricated Production Department, United States Chamber of Commerce, was the next speaker. His remarks covered many of the points brought out by Mr. Montgomery. He emphasized the suggestion that each division of trade should bear its own burdens, as dangerous ground is reached when one division tries to carry its own and others' burdens. Each trade organization should examine its own line and establish a code of ethics. The golden rule should be used in business so that a man's contract will be as good as his word, and so that constant breaking of contracts will make him a marked man.

That prices of machine tools cannot be reduced was the consensus of opinion of individual manufacturers. The causes for the necessity of price maintenance are

many, chief among them the sustained prices of materials; resumption of sales expense, which during the past few years has been almost negligible; service costs, necessary but expensive; improvements made during recent years; the cost of experiments; the maintenance of the present just level of wages for machinists and mechanics; increased overhead due to limited production; and the fact that prices of machine tools during the last five years have not increased in proportion to the costs of materials and labor.

The morning of the second day of the convention was given over to committee meetings and the afternoon to business. Atlantic City was chosen as the location for the Spring Convention to be held in May. The following officers were elected for 1921: President, August H. Tuechter, Cincinnati-Bickford Tool Co., Cincinnati, Ohio. First vice-president, E. J. Kearney, Kearney & Trecker Co., Milwaukee, Wis. Second vice-president, C. Wood Walter, Cincinnati Milling Machine Co., Cincinnati, Ohio. Secretary, Carl Dietz, The Norton Co., Worcester, Mass. Treasurer, Winslow Blanchard, The Blanchard Machine Co., Cambridge, Mass. Charles E. Hildreth of the Whitcomb-Blaisdell Machine Tool Co., Worcester, Mass., continues as manager.

What Other Editors Think

The Question of Cancellations

(From the *New York Commercial*)

WHENEVER a price movement reverses itself some one is bound to be caught at the end of the line. There is always a leader and always a tail-ender. When it is a matter of a reduction in prices, such as that now under way, some one is sure to be caught at the top and must suffer accordingly. In some trades such cancellations are accepted as a part of trade customs; in others the hardship to the seller is so great that they cannot be accepted.

There are two sides to the question, two distinct points of view. From the legal standpoint there is, of course, only one. A contract requires two parties in the making and it cannot be amended or cancelled without the consent of both parties. Very often the seller considers it to his best interest to agree to such cancellation with the best grace possible. It saves him his customer.

The seller, however, has some moral obligations that should govern, regardless of his legal rights, for moral law is superior to legal law. Shylock found it so and many another has discovered that it does not always pay to enforce the strict letter of a contract. If for instance, a seller, by enforcing a contract yielding him a huge profit, virtually bankrupting the buyer, although its cancellation would have caused him no loss, has violated the moral law. Hence, if the seller is to suffer loss through the cancellation of a contract, through no fault of his own, then the moral obligation rests with the buyer.

During this readjustment period many fine points will have to be worked out on the question of cancellations. If they can be made without injury to either party, well and good. If the buyer can reimburse the seller to the extent of the loss that might otherwise be incurred, there is a good basis for cancellation. If the seller is big enough to stand a partial loss of this kind, rather than to bankrupt his customer, thus saving him for another time, it is good business. These are times for giving and taking, for all will benefit in the long run through the adjustment now going on. There is, however, one class of buyer who is entitled neither to sympathy nor consideration; the one who, finding himself on the losing side, calmly repudiates his contracts without so much as "by your leave" and defies the seller to take whatever action he may see fit.

Where Is That Book of Ethics?

(From *Coal Age*)

WHEN the employer decided, on the simple basis of supply and demand, what wages should be paid the employee, there was little difficulty in determining what that rate should be. Whatever would induce the working or the professional man to enter into a verbal or written contract of employment was considered the correct compensation for the employer to pay.

Just recently when a wage controversy was being arbitrated a decision was rendered allowing a certain electric railroad to continue to pay the wage it had been paying, the arbitrators declaring that the electric road must have been paying a fair wage or it would not have been able to induce men to leave other employment to enter its service.

The public has decided that the law of supply and demand must be laid aside, yet it has elaborated no basis by which it may be replaced. We are henceforth to look to ethics for a determination of wages. But we have no ethical standards, no definitions of what is ethical economically. Shall there be a graduation of pay to suit graduations in intelligence and effort? Shall wages be advanced by flat or by percentage increases? Shall the steady worker get more or only as much as the one whose opportunity is irregular? Shall increases be based on the rates paid in the past or shall the status before the last revision be determinative?

An article is usually worth what people will pay for it. The ethical price concerns no one. The man who cannot pay an ethical price for it, or can buy the article cheaper from some one who can produce it at less expenditure of effort, will not pay the figure demanded, and hence the poor fellow who would have made it is unethically laid idle. A man working in a mine with coal hard to drill, shoot or break, by all *prima facie* elements of ethics should be paid more wages per ton, and even per day, than a man working in a soft seam.

According to ethics, he should, but will he? Only if the hard material is worth more than the softer. Natural laws have a way of paying little attention to what we poor mortals call ethics. The laws of survival of the fittest may not be ethical on their face, but they wipe out the needless industry, the concern which is making what the public does not want or what the public is unwilling to buy at the price at which it must be produced.

Progress Control as a Staff Function

By J. W. McCONNELL
General Master Mechanic, Naval Torpedo Station, Alexandria, Va.

It is advocated that systems of "Progress Control" be instituted in shops where the variety and character of the work have prevented its reduction to systematic, determinate control, and that such progress control be recognized as a staff function.

THERE is and has been for some time much activity with respect to the forms of shop management, the general purport of which is to substitute the determinate for the indeterminate, and thereby the efficient for the inefficient. The gigantic production built up around the automobile industry would not be possible if its many processes and activities were not determinate as to time and production. Other machine products, manufactured in a mere fractional quantity when compared to the automotive industry, but in much greater variety, such as machine tools, power plant units and accessories and transportation and electrical units, are produced for the most part upon the solid foundation of systematic methods of operation and control. But there are many shops where the variety and character of work have prevented its reduction to systematic, determinate control. An important step in this direction is a system of progress control exactly fitted to each local condition.

Of the many functions involved in the operation of a perfectly functioning manufacturing organization aside from the obviously essential details of buildings, power, equipment, materials, working force, etc., with its management, it is a personal view that progress control has not been given due importance by recognizing its identity as a distinct staff function. Though closely allied to production control, which is planning the work, establishing delivery schedules, procuring materials, issuing work orders, etc., yet it works on a different system, has different points of contact with the shops and offices, has no executive functions, has no technical characteristics, is strictly a staff activity, takes due note of all actions, advising alike manager, superintendent, division heads, or anyone else to whom it would be of value to know the standing of work in which they are interested parties.

The manufacture of a machine is predicated upon many things: design, drawings, patterns, castings, dies, forgings, commercial bar stock; commercially machined parts, special alloys (rolled, drawn, forged, heat-treated, tested). So much for materials. But how long does it take to get a steel casting? In this day of complicated and exacting design, of specialized industries and of large organizations, it is frequently a long and arduous passage from the quiet shades of the drawing room to the clean and fragrant confusion of the pattern shop, to the grime and smoke and heat of the foundry, before the castings are on your machine-shop floor. Mention might also be made of equal difficulties in getting forgings, special steels, and other materials. Then there are special tools, fixtures, jigs; operation planning and experimenting; and, perhaps, rate fixing. All of which is preparatory to the actual machining; this done there remains inspection, and finally, assembly. Many a busy superintendent will recognize subjects in this paragraph upon which timely information relating to progress and delay would give him the master key to firm control.

The degree of importance and the extent to which progress control should be employed as a functioning entity of the management staff rests upon the number and difficulty of the various activities involved. In this connection, one cannot but be dismayed when confronted by the multiplicity of activities. Many are of short duration, of easy performance; others are long and difficult; some are subject to consultation, trial, experiment; there are losses from spoiled work and defective material and the laborious, hurried routine for their replacement; they actuate all shops and offices; they are the sum total of practically the entire organization. And yet the very multiplicity of activities involved indicates the necessity of a systematic collection and dissemination of their scope and accomplishment as absolutely essential to harmonic production, smooth, steady, fast, unhurried.

It were well to bear in mind that the progress records of these activities have no future value. Theirs is only a present value. They will show the relation between production assets and liabilities; labor hours available; labor hours pledged; shops over- or under-manned. They will assist the timely transfer of men or work to and from departments and will answer questions as to when a job can be started, when it will be done. It is a too frequent, bad condition when the milling machine foreman telephones that he is ready to start a needed job but the tools are not ready, or the assembly foreman reports that he cannot proceed without some needed parts, not yet supplied. Such a condition necessarily exists without progress control. Word of mouth inquiries as to how this job is coming along, when will we get the forgings, when will the material be in, when will the tools be ready, will not call immediate attention to all delinquent activities, nor supply, on the moment, processes requiring time for their accomplishment. Lost time cannot be redeemed and rush work is an interference to orderly procedure that would not be tolerated were its actual cost in wear and tear in nervous energy and interference with other work known.

Based upon the foregoing conception of the functions and utility of progress control, the following procedure would apply:

(1) The Planning or Production Division prepares, without delay, a route sheet as its first act upon due notice of impending work. If a new job, not yet planned in detail, it is designated as a preliminary route sheet, and shows, in fair detail, all processes, a separate sheet for each part, and for each distinct assembly. Its purpose is to take note of actions needed and through its distribution to advise all concerned of action required of them. This preliminary route sheet is therefore early notice of work order requirements, useful alike to the production division, superintendent, shop heads, tool planner, etc. Revisions should be made in accordance with developed and approved procedure, for use on repeat orders.

(2) Progress control operates through a system of informal pencil memoranda reports of actions taken for the accomplishment of important or designated steps as indicated on the route sheet, or by established routine. All "key" activities, such as the preparation of tool sketches, of operation planning, ordering and delivery of material, release of drawings, and other acts preliminary to actual production should be subject to routine progress reports. It may be observed at this point that the mere requirement of systematic, routine progress reports is of itself one of the most efficient methods of securing the timely performance of duties assigned. The manner and frequency of these reports should receive the most careful forethought. A mass of undigested and indigestible data above all things is to be avoided. It is best to start with a few reports, limited to the most indeterminate ratio of time to production activities, and adding reports on other activities when their value becomes apparent. In any case, their scope depends entirely upon the nature of the product, the organization, and the wage system; they should originate from the person nearest the job having knowledge of its requirements.

(3) The mechanism of progress control must conform to three requirements:

Quick filing and ready reference.

The utmost simplicity of the report forms.

Classification of reports whereby related or specific activities may be quickly scrutinized.

Quick filing and ready reference may be obtained by means of a display board of good size, vertically mounted like the leaves of a book, with pockets or spring clips for holding the progress reports as received, without copying. These pockets or clips should be indexed or grouped so as to form an assembly list. Related activities on parts for assembly into a machine unit are thus joined. With respect to specific activities, that is, those relating to tools, drawings, etc., different colored slips afford visible differentiation. Simplicity of report forms consists in reducing the data required thereon to a minimum, even at the expense of occasional obscurity.

These forms should be printed on medium weight paper, with alternate leaves having a carbon back for duplicate copy, and bound in small perforated pads. The size of these pads should be about 3 x 3 in., although a larger size may have preference for special reasons. These reports would be filed as received, and taken together should show the current standing of all specific or related work orders.

(4) The following differentiation of specific or divisional activities is merely submitted as a guide; each application would be different, if carefully fitted to local conditions and requirements.

(a) A white index card, showing work authorized, and number or identity of route sheet, will be the first to be placed on the display control board.

(b) A blue slip will be used for all releases relating to work orders; auxiliary or supplemental work orders; tool orders; drawings, work and operation; operation schedules; and anything else that may relate to the issuance of authority to proceed.

(c) A yellow slip for all reports and progress information relating to materials; purchase requisitions; contract awards; deliveries; patterns; castings; forgings; and all activities relating to "materials."

(d) A pink slip to denote all tool activities.

(e) A white slip for production work; for operations performed; for operations completed; for work completed; for inspection.

(f) A red slip to denote spoiled work or defective material; breakdowns; arrested or reversed progress; work suspensions.

In conclusion it may be truthfully stated that the mark of efficient management is the determinate control of product with relation to time. It is equally true of the largest establishment as well as of its newest foreman that the mark of efficiency is to be able to make a delivery date, and keep it.

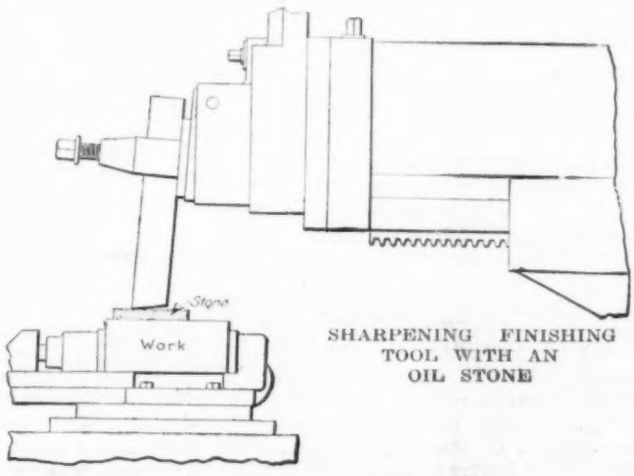
A Shaper Kink

By CHARLES D. FOLSOM, JR.

An old mechanic once said to me, "There are tricks to all trades but the machinist's trade, and that's all tricks." Here's one of them, a trick that comes in handy on shaper and planer work when you are using a flat finishing tool:

When the tool gets a little dull you will as a rule either take it out and regrind it or lift it up off of the work and try to smooth it with an oilstone. In the latter case you generally get a rounded edge which leaves feed marks, and then you have to grind it anyway. To save some of this trouble get an oilstone with fairly smooth and parallel sides and put it on the work directly under the tool. Lower the tool until it touches the oilstone, then lift the clapper box and lower it a little more, just about 0.025 in. or so. This amount of drop depends upon the clearance of the tool, and must be determined by trial; it is right when the cutting edge bears on the stone and the heel barely clears it, as shown in the sketch. Now all you have to do is to push the stone back and forth in the line of the feed, i. e., at right angles with the stroke of the machine. The clapper box must be at right angles with the surface being machined, as it naturally would be on straight finishing; otherwise the tool will cut on one corner.

This trick is useful sometimes before the tool is dull at all, that is, when setting up; it will save a lot of eye strain if the tool is comparatively narrow and in poor light. In such a case it is only necessary to set it approximately true, as the narrow edge can readily be stoned true.



SHARPENING FINISHING TOOL WITH AN OIL STONE

American Bankers To Organize 100-Million-Dollar Foreign Trade Corporation

Plans for the creation of a $100,000,000 foreign trade financing corporation, backed by leading financial and industrial interests of the country, are rapidly taking form, and it is expected that organization of this new instrument for furthering American export trade will be completed early in 1921. Representative bankers and industrial men are scheduled to meet in Chicago early in December at the call of John S. Drum, head of the American Bankers' Association, when definite steps toward forming the new corporation will be taken.

John McHugh, vice-president of the Mechanics and Metals National Bank and chairman of the committee of the American Bankers' Association, which inaugurated the plan for the corporation, believes that such an organization will prove as helpful to the business of the country and the proper financing of it as the Federal Reserve system already has shown itself. Discussing the proposed corporation, Mr. McHugh says:

"In connection with the consideration, on the part of the bankers of this country, of the proposed United States Foreign Commerce Bank, as suggested by the committee on commerce and marine of the American Bankers' Association, it might not be amiss to refer to the present banking system as operated under the Federal Reserve law. There are twelve Federal Reserve banks operated in the interest of the commercial business of this country under the supervision and direction of a central body known as the Federal Reserve Board. These banks have an aggregate capital of approximately $100,000,000. That capital has been supplied under compulsion of law, known as the Federal Reserve act, by the national banks of the country, and such state banks as elected to conform to the Federal Reserve law requirements in order to become members of the system. It has resulted in co-ordinating the banking power of the country in a way that has been of maximum helpfulness in the trying times that we have recently passed through and are now experiencing. It has proved to be a splendid piece of financial machinery for the commercial business of this country, but to that extent and no further can it go under the law.

"The foreign trade of this country, on account of the unique position of the United States in the last few years, has expanded to such an extent that a contraction to pre-war conditions would have a most depressing effect, and, therefore, it has come to be recognized that another large piece of equally important financial machinery is needed in order to finance that foreign trade and maintain it at such figures as will keep our people at work and our avenues of production adequately employed. This can likewise be done under the Federal Reserve law, owing to the fact that a recent amendment to that law, known as the Edge act, makes it possible, but not compulsory, for the banks of the country to furnish the needed capital therefor. It now is to be seen whether the banks of this country, required as they were by the Federal Reserve law to furnish the capital for the present Federal Reserve Bank system, will, without compulsion of law, and of their own free will and accord, rise to the occasion and bring into existence another equally important piece of financial machinery.

"It is estimated that at the present time loans or credits in connection with the foreign trade of American importers aggregate approximately four billions of dollars, and it is a well known fact that a great deal of this is directly or indirectly carried by the banks of the country in short time form, but as much of it must be renewed from time to time it, in fact, represents long time credits. Long time credits are undesirable from the standpoint of prudent commercial bank management and are not in harmony with the spirit of the Federal Reserve act in so far as it applies to commercial bank business. Such long time credits should be handled by an investment corporation of wide and extensive distributing ability, and if they were so handled there would be a marked improvement in the banking situation. Such corporation can come into existence through the co-operation of the banks and business men of this country, and if it be brought into existence I am confidently of the opinion that it will prove as helpful to the business of this country and the proper financing of it as the Federal Reserve system already has done."

Russian Orders for the German Industry

Soviet Russia has been trying for a long time to buy machines in Germany. Negotiations have gone so far that large orders are on the point of being placed. The first order of this kind is one for 6,000 locomotives of various sizes and a large amount of turbines. Contracts have been closed subject to satisfactory methods of payment.

Third National Marine Exposition Schedule for New York in January

Completing the triangle, the third National Marine Exposition will combine with the interest of the first and second a new force and optimism.

The National Marine League is in the midst of lively preparations for a mammoth marine show in New York in January. Having allied with its organization the great latent maritime power of the Middle West, which during the Chicago Exposition showed live interest and active demonstration, this third National Marine Show will carry a new force and well-founded optimism.

The outstanding feature in the first New York show was the arousing of interest in the general public—the bringing of a great mass of American voters to a state of shipmindedness which will eventually take concrete expression in a voting voice for the betterment and protection of the American merchant marine. This lively interest which was so evident on all sides, was instrumental in developing the second project—a marine show in Chicago, 1,000 miles from tidewater.

P. H. W. Ross, president of the National Marine League, who presided at the Chicago show was responsible for much of the success of the undertaking. He visualized to the people in well-grounded common-sense argument the great advantages which would accrue from the opening up of this region—the great land-locked heart of the country. His energy and enthusiasm proved definitely that the National Marine League exists to serve both the inland and oceanic necessities of the United States.

The January show, gathering interest and force, and embracing more and more of the country, will offer larger opportunities, more forceful connections, and broader influences than either of the other expositions. That this is fully realized is shown by the unprecedented demand for space. By Nov. 1 the number of exhibitors had already passed the entire number represented in the Chicago show.

Being set, as it were, almost as a forerunner of the ushering in of the new Presidential administration—an administration pledged to the support of the American merchant marine—the third National Marine Exposition will mark the turning of the tide in things maritime. It will herald a new era—the placing of the American merchant marine in a position of stability which will further its uphill fight for supremacy on the seas.

LD'S INDUSTRIAL FORGE
News Editor

Drastic Tariff Laws To Protect American Manufacturers To Be First Act of New Congress

The tariff bill that will be passed by the incoming Republican congress promises to be the most drastic protective measure that has ever appeared upon the Federal statute books, according to Republican senators and representatives now in Washington. It will be ready early next summer.

Representative Joseph W. Fordney, chairman of the house ways and means committee, is already hard at work upon the schedules and will soon have assistance from Senator Smoot.

The bill, it was learned today, will include every sort of commodity in which America is in competition with foreign countries where labor and raw materials are cheaper, but will be especially aimed at protection of farm products, manufactured goods, steel and iron products.

Summarizing the situation which, in his opinion makes a high tariff imperative, one senator said today:

"Producers of all sorts of farm products, particularly wool, are facing bankruptcy and must be protected. Factories are shutting down all over the United States because American employers cannot produce certain classes of goods in competition with various countries abroad. Unemployment is becoming or soon will become a serious threat. The only logical, sensible, and practical way to meet this situation is to pass a drastic protectionist tariff. The tariff will do much to increase the revenues now greatly needed to meet a mass of indebtedness."

While declining to discuss the policy of a high protective tariff, David J. Lewis, a member of the United States Tariff Commission, pointed out today that a low tariff has frequently produced as much revenue as the higher schedule, which shut off revenue by discouraging imports.

The last protective tariff was that provided by the Payne-Aldrich bill. Under it the duty of various imported articles ranged between 1910 and 1914 from 40.03 per cent to 43.15 per cent. Under the Underwood tariff the rates varied from 21.27 per cent to 27.18 per cent between 1917 and 1918.

Germany's Trade with Belgium

The German export trade to Belgium in the first eight months of this year was 486,000,000 francs while the Belgian export trade to Germany was, at the same, 779,000,000 francs. Germany has become the third largest buyer of Belgium.

Hartman Elected to Board of N. C. R. Company

William Hartman, superintendent of the National Cash Register Co., has been elected to the board of directors of that organization. This action was taken at the regular meeting of the board, Wednesday, Nov. 3.

Mr. Hartman has been with the N. C R. for thirty years. He started in the ranks when the factory consisted of but two or three small buildings. He was promoted from time to time, and by hard work and careful study won his way to his present position in the organization

WILLIAM HARTMAN

During the latter part of 1918 Mr. Hartman became superintendent of all the manufacturing departments, which position he now holds.

His election to the board of directors is a recognition of his industry, integrity and ability.

A. S. M. E. Passes Resolution to Increase Endowment of Engineering Foundation

The following resolution was adopted by the council of the American Society of Mechanical Engineers:

Resolved, That the officers of this society be authorized and requested to co-operate with the officers of Engineering Foundation, and the officers of the Societies of Civil, Mining and Electrical Engineers, in promulgating a plan for increasing the endowment of Engineering Foundation and that when the plan is adopted the officers of this Society are hereby authorized to circularize the membership of this Society with reference thereto.

Fisher Says Lack of Religion and Broken Covenants Are Responsible for Present Conditions

With textile manufacturers and shoemaking concerns of New England facing the choice of closing their plants, running on a part time schedule or requesting their employees to accept reductions in salary as the result of a situation daily becoming more acute in this industrial center because of the heavy cancellation of orders and unsettled market conditions, Oliver M. Fisher of Newton, Mass., head of one of the large shoe manufacturing plants here, advises a return to the ancient Biblical precept of responsibility to God and to one's fellow-man as a solution of the problem.

Otherwise, Mr. Fisher says, the irreligious trend of this country, with 60 per cent of the population not even nominally connected with any church, will break down existing morals in the business world and will put approval upon "a standard of business integrity which before the war no business man would believe existed." A condition approaching chaos is facing the business world, according to Mr. Fisher, due, in a large measure, he says, to the lack of faith of one man in another and the attitude of regarding contracts as "scraps of paper."

Following his recent election as president of the Boston Boot and Shoe Club, Mr. Fisher, who is treasurer and member of the executive committee of the Unitarian campaign under the direction of former President William H. Taft, gave out a statement in which he said:

"This country has been a phenomenal success in everything material. We have been the wonder of the world, but we have lost, to my mind, the balance, and have given far more attention to the material side of life than its importance warrants. The same attention given to the development of the moral and spiritual forces within us could bring about in every community a visualizing force which would make better communities, and thus make better the very business in which we are engaged.

"From my own business experience there is nothing on earth that business needs so much today as religion. By that I mean responsibility to God, to man and to the obligations that go with it, in order that our relations with each other shall be the relations of one brother to another. Obligations must be kept and the covenants we make must be considered sacred and binding: therefore, I have come to feel after a long business life that some form of

Christianity is the heart of the covenant of all business life.

"You who are in business have been conscious of a tremendous overturning recently in business affairs; in fact, a condition approaching chaos is with us at this time. If you will look at the causes of this you will find that it is very largely due to the lack of faith of one man to another in his business obligations.

"Our textile mills here in New England, as you know, are nearly all closed, or practically so. Our shoe manufacturing plants, one of the largest industries of New England, are practically all closed—and why? Not because shoes are not needed, not because textiles are not needed; but because the covenants entered into, the contracts made, have been torn and broken; and in the face of the fact that the merchandise would be needed, that this cancellation or return would mean financial loss and ruin to the other party."

Landis Machine Co. Holds House-Warming Party in New Shop

The Landis Machine Co., Waynesboro, Pa., gave a house-warming party in its new shop to employees and their families, on Oct. 30. The new fireproof building covers a little over one acre of floor space inside its walls, the dimensions being 146 x 308 ft. There are 729,406 pounds of steel which means about 365 tons in the construction of same.

C. N. Kirkpatrick was general chairman, in full charge of the house-warming arrangements. The advisory committee to assist him was made up of S. F. Newman and J. G. Harper.

Nearly 1,400 men, women and children gathered in the shop Saturday afternoon for the housewarming. The gong sounded at 3 o'clock and until a late hour in the evening there was not a dull moment. Provision had been made for the entertainment of young and old and interested participation in the numerous activities emphasized the perfection of the arrangements.

While the very juvenile part of the audience was amusing itself on the swings, teeter-boards, slides and sand piles and filling its stomachs with apples, the more sedate sat upon the rows of benches which were arranged before the platform and listened to the remarks of S. F. Newman, assistant general manager, and J. G. Benedict, general manager, at the beginning of the program.

Motor Truck Association to Hold Exhibit in New York

The annual show of the Motor Truck Association of America will be held in New York City on January 3 to 8, 1921. The exhibition will be staged in the Twelfth Regiment Armory at 62d St., and also in the First Field Artillery Armory at 68th St. These two buildings will afford a floor space of approximately 25,000 sq.ft. Drawings for space were held on Nov. 18 at the office of the association.

Auto Builders Predict Great Prosperity

"The automobile industry is bound to feel the beneficial effects of the election of Senator Harding as President," said A. T. Waterfall, of Dodge Bros. "We are preparing for a release of the pent-up demand for cars and so far as Dodge Bros. are concerned we are working 100 per cent on production in anticipation of better times to come. While as yet unreflected in general lines of business, Harding's election has created a pronounced atmosphere of optimism in Detroit financial circles."

Bankers and some automobile manufacturers who have studied possible effects of the change in administration at Washington declared today that the country is on the verge of the greatest period of prosperity in its history.

THE MAN WITH A JOB IS A CO-WORKER OF THE MAN WHO GAVE HIM THE JOB.
BOTH ARE HUMAN AND GOOD FELLOWS—LET'S PULL TOGETHER FOR THE COMMON GOOD.
THERE'S SOMETHING TO THAT.
PAINT

—From the "Hex"

The Continental Motors Corporation, of Muskegon, after a shutdown of three weeks has started to hire men.

The Continental is one of the largest makers of automobile motors in the world and its resumption is considered an augury of optimism in the industry.

Equalization of U. S. Exports and Imports Is Improving

The figures in detail of United States foreign trade during August, the last month for which complete data is available at this writing, indicate a further substantial improvement in the process of equalizing this country's exports and imports of goods and commodities. The excess of visible exports over imports in August was reduced to the new low record of $65,000,000, the best previous showing, since an equal balance of trade if not an import excess became desirable, being $78,000,000 export excess in June of the current year. The unfortunate feature of the August record, however, is that the improvement was not brought about by an increase in imports, which as a matter of fact decreased from $537,000,000 in July to $514,000,000 in August, but instead by a falling off of $72,000,000 in August exports as compared with the July total of $651,000,000.

Moreover there are many indications which point to the probability that the shrinkage in American merchandise exports may become more, rather than less, pronounced in the months immediately ahead. This is not likely simply because of increased competition from other industrialized nations, though that, of course, may prove to be a contributing factor in certain lines and localities, nor is it resulting, or likely to result, from a lack of demand from most of the world's leading markets. As a matter of fact it seems to be as true today as it was six months ago that, taking the world as a whole, actual consumer needs still are ahead of actual supplies, though there may be in a few markets and a few lines of goods an apparent oversupply at one or another point in the channels through which goods must flow on their way to final distribution.

What seems most likely to affect adversely American exports are the stringent financial conditions both here and in foreign markets, and the unsettlement in the price situation all over the world. Buyers of American goods abroad find the prospect of lower prices an inducement to delay the placing of business, and in addition there is the very important fact for them to consider that prices in their own markets are by no manner of means stable and that goods bought in the United States now, even at the present reduced prices, may not be readily marketable several months hence when they would be delivered in the buyer's country because of the possibility of still further reactions there.

Lectures at Franklin Institute in December

On the program of lectures, provided during the winter months at the Franklin Institute of the State of Pennsylvania, Philadelphia, appear three very important subjects for the month of December.

On the 2nd a lecture on "The Structure of Photographic Images," by C. E. Kenneth Mees, D.Sc., will be given. Dr. Mees is director of the research laboratories of the Eastman Kodak Co., at Rochester, N. Y., and is well qualified to speak on this subject.

December 9 will hear John S. Shearer, B.S., Ph.D., on "Recent Advances in the Production and Application of X-Rays." Dr. Shearer is a member of the faculty of Cornell University, Department of Physics.

"Some Operating Characteristics of Electron Tubes," will be the subject of W. C. White, E.E., on December 15. Mr. White is connected with the General Electric Co., at Schnectady, N. Y.

James Hartness Elected Governor of Vermont

James Hartness, president of the Jones & Lamson Machine Co., of Springfield, Vermont, manufacturers of lathes, etc., was elected Governor of Vermont on the Republican ticket at the recent election. Governer-elect Hartness has been connected with the machinery industry for a number of years.

Norway as a Market for American Machinery

"American automobiles and trucks are so predominant in Norway that they give a distance American touch to the street traffic," states Trade Commissioner Nels A. Bengtson, of the Bureau of Foreign and Domestic Commerce of the Department of Commerce, in a report just made public.

"American agricultural machinery is prominent in Norway. In general the high quality of American tools and mechanisms is conceded and the expression is frequently heard that American goods rank first in quality but are somewhat higher in price than the same type of goods from the United Kingdom, Sweden or Germany. The United States now ranks first in the trade in metal manufactures as a whole. Before the war Germany ranked first, the United Kingdom second and the United States third," says the report.

Germany Holds Sixth Place in Trade with U. S.

The German-American Trade Society (Deutsch-Amerikanischer Wirtschaftsverband) held a meeting recently after an interval of five years. From a statement made to its members it is interesting to learn that Germany has again assumed the sixth place among European countries with regard to trade with the United States. The society has lately been filled up by a great number of new members recruited from the largest German manufacturing and commercial circles. Great satisfaction has been expressed of this increase of membership as an evidence of the interest in the re-establishment of trade relations with the United States.

Holland's New Largest Incorporated Company

The R. S. Stokvis & Zonen, Ltd., in Rotterdam, one of the largest continental dealers of machinery and known in the United States as a representative of a considerable number of American machine-tool builders, has recently entered into a combine with the Furness Shipping Co. The incorporated company has been formed under the name of "Nederlandsche Maatschappij voor Scheepvaart, Handel en Nijverheid" in Rotterdam (Dutch Company for Shipping, Commeree and Industry) with a capital of 100,060,000 fl. The Furness Co., originally a shipping agency only, now controls large interests in Dutch commerce and shipping. It is the owner of ten companies, among which are the "Nieuwe Waterweg," the "Maschinefabriek Delftshaven" and the lignite mining company Carisborg. It further owns a controlling interest of seven other companies, including the "Alliance Transportation Co." in New York and London which acts as shipping agent for the combine. Stokvis & Zonen maintains eleven branches in Holland and has offices in Paris, Brussels, Petrograd, New York and London, the latter under the style of the "Metal and Hardware Products, Ltd." The New York office is the American buying office of the company. Besides the company owns cycle works, a steel export company in Rotterdam, and the "Automatic Screw Works" in Nijmegen.

The newly formed combine represents the largest incorporated company in Holland and one of the biggest of the whole continent of Europe. Th. Stokvis is one of the managers. Two other of the Stokvis brothers, H. Stokvis and L. Stokvis, are directors.

Penn. R. R. Seeking New Market for Cross-Ties

Owing to the unprecedented levels to which prices of railroad cross-ties have risen in this country the Pennsylvania R.R. has decided to investigate the adaptability of the hard woods of Central and South America for this purpose. Inquiries have been started along several lines not only to ascertain how much more cheaply ties or the material for ties can be purchased in those countries, but also to investigate the question of the longer life of ties made from the Southern hard woods, as compared with those made from the North American native woods heretofore chiefly used.

Under normal conditions the Pennsylvania R.R. System uses from five to six million cross-ties annually. White oak, the most desirable North American wood for this purpose, is becoming rapidly scarcer. The other available woods in this country have a very short life as ties, unless creosoted, which adds materially to their cost.

Changes in Dittmer Gear Corporation

R. H. Bowyer, formerly factory manager of the Dittmer Gear and Manufacturing Corporation, has been appointed sales engineer. This places an experienced and technically trained gear man at the disposal of Dittmer's customers.

George E. Wilkinson, formerly chief inspector, has been appointed factory manager.

E. L. Sherman has been promoted to supervisor of inspection.

Erratum

In a recent issue of *American Machinist* we published a notice stating that the Motor Boat Meeting of the S. A. E. would be held on Dec. 4. The notice should have read Dec. 14 and we are glad to make this correction.

The University of California has opened a new term in the machine shop course, which offers training to the mechanic and the apprentice alike. The classes are being held at night in the Polytechnic High School, First Ave. and Frederick St., San Francisco, Cal.

Brainard Steel Co. Opens New Plant

The J. W. Brainard Steel Co., of Warren, Ohio, is now occupying its new $300,000 plant, the erection of which was started last summer. This plant is located in the new industrial center in the northern part of the city.

The J. W. Brainard Steel Co. absorbed the Fowler Rivet Co., of Braddock, Pa., and has moved all the equipment of that company to Warren. Its specialty was Armco iron rivets, black and galvanized, made for the American Rolling Mill Co., of Middletown, Ohio, which it will continue to make. In addition, Mr. Brainard has added to the product a steel hoop for slack cooperage patented by him, and is now about ready to put on the market a steel head also used in slack cooperage. The market for these last two items is enormous and the demand would indicate capacity output for them for some time.

The officers of the company are J. W. Brainard, president; A. N. Martin, vice-president; and B. A. Brainard, secretary-treasurer.

Obituary

Arthur E. Hauck

ARTHUR E. HAUCK, president of the Hauck Manufacturing Co., Brooklyn, N. Y., manufacturer of oil-burning appliances, kerosene torches, furnaces and forges, died at his home in Brooklyn on Oct. 30, aged forty-one.

He began his career by learning coppersmithing in Germany. After learning his trade, he left his mother country to follow his trade in the navy and ship yards of Belgium, France and later in England. He arrived in this country when twenty years of age. He had only enough funds left when arriving in Philadelphia to pay for his first night's lodging, but the next day he obtained employment at the Philadelphia Navy yards.

After working for three years in the Navy coppersmithing shops in Philadelphia, Norfolk, Baltimore and Brooklyn, he started in the oil-burner business in 1902 with a small shop in Brooklyn. His pioneer work was the basis for a great bulk of industrial oil burning today. His tireless industry continued with the development of the oil-burner business which carried his name. Its consistent growth and development include over a score of important basic patents in burning oil, kerosene, etc., as well as numerous minor inventions and improvements which deal with applications of burning oil for a great many uses.

HENRY C. KING, president of the American Mason Safety Thread Co., Lowell, Mass., died Oct. 28 after a short illness. Mr. King was very well known in industrial circles throughout the United States and was one of the

first to introduce the safety thread in America.

GEORGE BROWN LIMBERT, founder and president of George B. Limbert & Co., and for twenty years a leading figure in the iron industry died recently in his home in Chicago.

JOHN EDWARDS FRANKS, Southern representative for the Lackawanna Steel Co., died at his home in Atlanta last week.

JULIUS GREENTREE, treasurer of the Buffalo House Wrecking and Salvage Co., died on Oct. 22.

Personals

JOHN W. HIGGINS, president and treasurer of the Worcester Pressed Steel Co., Worcester, Mass., was elected a member of the executive committee of the Associated Industries of Massachusetts, at the recent annual meeting held at the Copley-Plaza Hotel, Boston.

H. B. CHAMBERLAIN, who recently resigned as secretary of the Chamber of Commerce, of New Britain, Conn., has accepted a position with the Fafnir Bearing Co., of New Britain.

CHARLES L. ALLEN, treasurer and general manager of the Norton Co., Worcester, Mass., was elected as a member of the executive committee of the Associated Industries of Massachusetts, at the fifth annual meeting of the association held in Boston, Oct. 28.

R. A. SEATON has been appointed dean of the division of engineering and director of the engineering experiment station at the Kansas State Agricultural College, to fill the vacancy made by the resignation of Dean A. A. Potter. Previous to his appointment as dean, Mr. Seaton was professor of applied mechanics and machine design and in charge of the road materials testing laboratory.

DAVID MOULTON, formerly assistant mechanical engineer for Monks & Johnson, Boston, Mass., is now with the Walworth Manufacturing Co., Boston.

GEORGE W. CRAVENS is now vice-president and general manager for the Universal Body Corporation at Mishawaka, Ind.

JAMES D. MOONEY, until recently assistant to A. P. Sloan, Jr., vice-president of the General Motors Corporation, has been made general manager of the Remy electric division of that corporation, Anderson, Ind.

RALPH T. BRATT has severed his connection with Olney & Warrin, Inc., and is now employed in the industrial department of the Locomotive Superheater Co., New York.

JEROME R. GEORGE, vice-president of the Morgan Construction Co., Worcester, Mass., manufacturer of rolling mill machinery, was chosen an executive committee member of the Associated Industries of Massachusetts, at the fifth annual meeting held at Boston recently.

DOMESTIC EXPORTS FROM THE UNITED STATES BY COUNTRIES DURING SEPTEMBER, 1920, METAL-WORKING MACHINERY

Countries	Lathes	Other Machine Tools	Sharpening and Grinding Machines	All Other
Belgium	$84,799	$48,244	$29,667	$25,390
Denmark	.....	1,973	.....	1,671
Finland	.....	863	.....	.....
France	10,447	90,680	15,129	336,680
Germany	.....	.....	1,512	.....
Greece	.....	.....	363	.....
Italy	39,225	57,164	506	24,063
Netherlands	10,981	12,348	3,641	.....
Norway	50	7,506	.....	304
Poland and Danzig	740	.....	400	.....
Portugal	.....	.....	.....	2,048
Roumania	.....	1,816	.....	402
Russia in Europe	.....	42,800	.....	.....
Spain	1,684	17,045	1,582	4,373
Sweden	7,197	10,515	11,220	4,106
Switzerland	2,922	1,277	438	.....
Turkey in Europe	6,356	.....	.....	.....
England	88,531	178,760	107,460	270,109
Scotland	.....	3,240	224	693
British Honduras	.....	.....	23	41
Canada	50,756	136,098	43,035	190,085
Costa Rica	108	33	.....	.....
Guatemala	323	30	.....	60
Nicaragua	24	.....	.....	.....
Panama	.....	550	.....	.....
Mexico	7,316	9,739	9,564	10,731
Newfoundland and Labrador	.....	350	.....	20
Barbados	.....	299	.....	99
Trinidad and Tobago	.....	1,779	.....	.....
Other Brit. West Indies	700	.....	.....	.....
Cuba	32,663	29,721	2,889	21,077
Dominican Republic	2,298	293	.....	.....
Argentina	8,935	16,370	2,604	3,530
Brazil	4,786	17,398	1,297	1,973
Chile	.....	1,322	4,495	154
Colombia	3,402	2,529	728	.....
Ecuador	.....	27	.....	.....
Peru	4,602	1,455	2,752	1,014
Uruguay	2,025	2,073	.....	950
Venezuela	1,923	474	.....	414
China	53,009	238,985	10,931	6,137
Chosen	2,650	.....	.....	.....
British India	16,233	28,143	7,564	31,309
Straits Settlements	.....	221	.....	.....
Other British East Indies	.....	.....	120	.....
Dutch East Indies	482	252	2,142	153
French Indo China	1,725	.....	.....	.....
Hongkong	7,299	43,534	.....	99,117
Japan	13,844	104,571	55,581	116,746
Siam	.....	.....	588	.....
Australia	14,851	36,826	13,701	19,185
New Zealand	11,646	5,506	239	7,086
Philippine Islands	12,249	6,825	2,154	3,258
British South Africa	.....	16,262	1,059	6,317
Kamerun, etc.	.....	.....	.....	1,048
Portuguese Africa	.....	279	236	.....
Total	$506,781	$1,176,175	$333,844	$1,190,343

Business Items

The Ilg Electric Ventilating Co., Chicago, Ill., has moved into its new plant at 2850 North Crawford Ave.

The Investing and Manufacturing Co., Bridgeport, Conn., has been organized recently to investigate, develop and aid small manufacturers and other mercantile business to locate, operate, etc. The capital stock is $100,000.

At a meeting of the stockholders of the Columbia Rubber Mills of Sheboygan, Wis., the following officers were elected: President, Leo Hofmeister; vice-president, Dr. F. Nouth, and treasurer, M. Holderson. The company's new plant will be ready for occupancy by Jan. 1, 1921. Rubber belting will be manufactured for wholesale use.

A part of the Meriden plant of the Colt's Patent Fire Arms Manufacturing Co. has been sold to the Aeolian Co. of Meriden. This part sold was used as a toolroom by the Colt company.

The Wickwire-Spencer Steel Corporation, of Worcester, Mass., and Buffalo, N. Y., has recently purchased a tract of land and several buildings in the Port Morris section of the Bronx, in New York City, to be utilized as a New York warehouse. The acquisition of this property will enable the company to use it as a distributing center for the nearby states.

The cotter-pin business of the Ohio Wire Goods Co., of Akron, Ohio, has been purchased by the Falls Rivet Co., of Kent, Ohio, and the machinery in the department is being removed to the Kent plant. The remainder of the Akron plant remains intact.

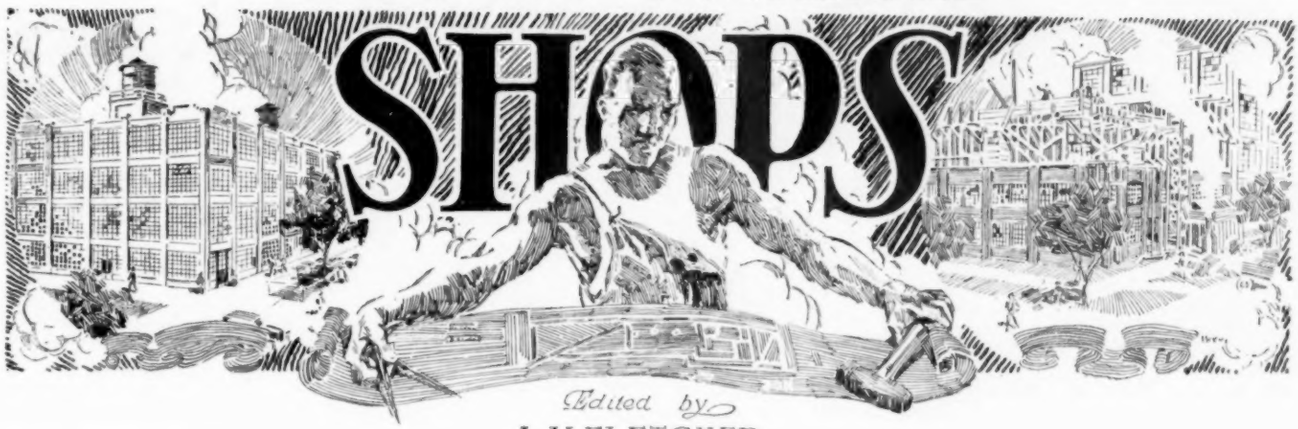
Forthcoming Meetings

The Federated American Engineering Societies will hold its first meeting at the Hotel New Willard, Washington, D. C., on Nov. 18 to 20 inclusive.

The 1920 annual meeting of the American Society of Mechanical Engineers will be held in the Engineering Societies Building, 29 West 39th Street, New York City, from Dec. 7 to Dec. 10.

The Society of Automotive Engineers will hold its annual meeting on Jan. 11 to 13 inclusive at New York.

NEW *and* ENLARGED



Edited by
L·V·FLETCHER

Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

N. Y., New York (Borough of Manhattan)—The Biddell Purchasing Co., 107 Chambers St.—3 high-speed metal slitting and sawing machines, 21½ in. outside diameter, to swing from floor.

N. Y., New York (Borough of Manhattan)—Rippenbein Siebert Co., Inc., 133-137 Front St.—machine for the manufacture of metal combs.

N. Y., Rochester—G. C. Humbert, 301 Cornwall Bldg., manufacturing jeweler—one automatic roller and a 100 lb. hammer (in good condition).

Pa., Philadelphia—The Pennsylvania R.R., 17th and Filbert Sts., A. Clem, Purch. Agt.—one 30 in. lathe and one 36 in. boring mill.

Pa., Philadelphia—J. Waldow and A. Samenfield, 707 Walnut St.—garage equipment.

Pa., York—A. R. Cruse, Room 23, Security Bldg.—one straightening machine for bars ¼ in. thick and ranging in width from ¾ to 1¼ in.

Pa., York—W. E. Duff Co., 215 North George St.—one keyseater-up to 1¼ in. capacity (used).

Ky., Louisville—The Waller-Tautman Bros. Motor Co., 2613 Cane Run Rd., G. Waller, Pres.—garage and repair shop equipment.

Ill., Chicago—The Dawson Mfg. Co., 2012 Larrabee St., manufacturers of grease cups—back geared punch press, 4 in. shaft, 3¼ to 4 in. stroke.

Ill., Chicago—E. Mallinson, 436 West 63d St.—one 24 in. to 30 in. iron planer.

Ill., Chicago—F. H. Parker Co., 1st Natl. Bank Bldg.—one 30 in. to 40 in. old style engine lathe, one 8 ft. to 12 ft. squaring shear to cut ⅝ in., and one 24 in. friction shaper.

Ill., Quincy—The Wall Pump & Compressor Co., Box 381—one plain milling machine and an 18 in. x 8 ft. lathe.

Ind., Whiting—The Standard Oil Co., Front St.—machine tools for the manufacture of welded steel barrels.

Mich., Mt. Clemens—The Sauzedde Mfg. Corp.—equipment for the manufacture of wire wheels.

O., Cincinnati—The Weir Frog Co., Beech Highland and Norwood Aves.—one 3 in. x 36 in. turret lathe, one 40 in. or 42 in. engine lathe, 14 ft. long, one open side planer, 42 in. x 12 or 15 ft (used).

O., Leetonia—The Fabricated Steel Products Co., Front St.—new equipment for barrel plant.

O., Salem—The Victor Stove Co., Depot St.—one hand operated corrugated roll for light sheets.

Wis., Ft. Atkinson—The Bull Milking Machine Co., North Main St., L. Bull, Mgr.—$30,000 worth of equipment for its machine shop and factory, to include 3 drill presses, one 26 in., one 20 in. and one 14 in. turret lathes, 6 tool turret head, about 1¼ in. spindle, engine lathe, about 18 in, 7 ft. bed, about an 18 in. shaper and a universal grinder.

Wis., Kaukauna—The Kaukauna Motor Car Co.—boring mill for garage.

Wis., Milwaukee—The Bub Body Corp., 691 8th Ave., manufacturers of auto bodies and parts, B. Zwebel, Purch. Agt.—sheet metal working machinery.

Wis., Oakfield—The Romort Mfg. Co.—machinery for the manufacture of garage equipment.

Wis., Racine—The Bd. of Industrial Educ., City Hall—manual training equipment.

Wis., Racine—The General Ry. Devices Co., 144 Main St., W. Osborne, Purch. Agt.—machine tools for the manufacture of railway equipment.

Minn., Ortonville—The Ortonville Auto & Supply Co.—one small size about 10 x 32 universal grinder. Norton or Landis preferable, one No. 60 Heald cylinder grinder, or one of about the same size of some other good make. (Second-hand.)

Tex., Ranger—The Ranger Boiler Wks.—machinery for rolling, turning and boring sheet and structural steel.

Utah, Salt Lake City—The Salt Lake Hardware Co., 257 South Main St.—one motor driven shear capable of shearing 1½ in. rounds and ½ in. x 6 in. angles.

Ont., Listowel—B. L. Bamford—equipment for the manufacture of steel wire and wooden wheels for autos, trucks and bicycles.

Machinery Wanted

Md., Baltimore—Lyon, Conklin & Co., Inc., 13 Balderston St., R. H. Lyon, Purch. Agt.—machinery for the manufacture of roofing, spouting, etc.

N. Y., New York (Borough of Manhattan)—P. Engel, 410 East 32d St., manufacturer of art furniture and varnishes—one wood bandsaw.

Pa., Philadelphia—The Morris Truck & Wheel Co., 75th St. and Island Rd.—woodworking machinery.

Mich., Rubicon—The Rubicon Lumber Co.—power saws for its planing mill.

Wis., Kaukauna—The Moloch Co.—one traveling crane for machine shop.

Wis., Manitowoc—The Drost Box Mfg. Co., South 9th St.—woodworking machinery.

Wis., Oshkosh—The Fuller Goodman Co., City Natl. Bank Bldg.—new planing mill machinery.

Wis., Seymour—The Seymour Woodenware Co., S. A. Konz, Purch. Agt.—one 6 in. band resaw, one 66 to 72 in. veneer lathe and one sectional roll planer.

Wis., West Bend—The Miller Spouting Co., Inc., P. O. Box 425—crane and sheet metal working machinery for the manufacture of mill spouts.

Ark., Earle—The Grenada Cotton Compress Co.—cotton compress machinery.

Wash., Seattle—A. M. Castle Co., 1201 1st Sts.—two 80 ft. traveling cranes.

Metal Working

NEW ENGLAND

Me., Old Town—The Bangor Ry. & Electric Co., 90 Harlow St., Bangor, plans to build a 2 story, 70 x 75 ft. pumping and sub station here. Crowell & Lancaster, Exch. Bldg., Bangor, Archts.

Conn., Hartford—P. A. Buffina, 203 Front St., is having plans prepared for the construction of a 1 story, 40 x 60 ft. garage on Front St. Estimated cost, $10,000. Marchetti & D'Avino, 756 Main St., Archts.

Conn., Hartford—A. Cohn, 25 Russell St., has awarded the contract for the construction of a 1 story, 35 x 50 ft garage on Russell St. Estimated cost, $10,000.

Conn., New Haven—T. E. McAviney, 169 Columbus Ave., will soon award the contract for the construction of a 2 story, 40 x 65 ft. garage on Columbus Ave. Estimated cost, $20,000. Private plans.

Mass., Arlington—W. K. Hutchinson, 659 Massachusetts Ave., plans to build a 1 story, 50 x 90 ft. addition to his garage on Massachusetts Ave. Estimated cost, $20,000. Private plans.

Mass., Braintree—The Tidewater Oil Corp., 34 Central Wharf, Boston, has awarded the contract for the construction of a 1 story, 40 x 70 ft. garage on Union St. Estimated cost, $15,000.

Mass., Malden—S. Sagal, 103 Willow St., will build a 1 story garage on Willow St. Estimated cost, $20,000.

Mass., Millbury—P. Lynch, Elm St., will build a 1 story, 55 x 70 ft. garage. Estimated cost, $15,000.

Mass., New Bedford—J. McMurray, 6 Park Pl., plans to build a 1 story garage. Estimated cost, $12,000. O. Crapo, 514 Bowditch St., Archt.

Mass., New Bedford—The Motor Sales Co., 514 Pleasant St., has awarded the contract for the construction of a 2 story service station to cover about 14,000 sq.ft. floor space, on Purchase St. Estimated cost, $100,000. Noted July 22.

Mass., Somerset—The Somerset Stove Fdry. Co. has awarded the contract for the construction of a 1 story, 70 x 160 ft. foundry. Estimated cost, $50,000.

Mass., Springfield—Grudell Bros., 43 Sargeant St., have awarded the contract for the construction of a 1 story, 50 x 80 ft. garage on Orange St. Estimated cost, $20,000. Noted Nov. 11.

Vt., Rutland—W. H. Williams, c/o G. F. Lamb, Archt., Gryphon Bldg., plans to build a 1 story, 70 x 130 ft. auto service station on West St.

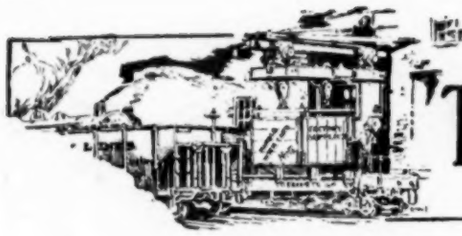
MIDDLE ATLANTIC STATES

Md., Baltimore—Lyon, Conklin & Co., 13 Balderston St., will soon award the contract for the construction of a 238 x 435 ft. plant for the manufacture of roofing, spouting, etc.

Md., Baltimore—F. Phillips & Sons, 1336 Greenmount Ave., plan to build a blacksmith shop. Estimated cost, $10,000.

Md., Towson—Black & Decker Co., manufacturers of special machinery, etc., have awarded the contract for the construction of a 1 story machine shop.

(Continued on p. 972h)



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	Current	One Year Ago
No. 2 Southern	$46.50	$30.35
Northern Basic	51.30	27.55
Southern Ohio No. 2	48.50	28.55
NEW YORK—TIDEWATER DELIVERY		
2X Virginia (Silicon 2.25 to 2.75)	57.12	32.40
Southern No. 2 (Silicon 2.25 to 2.75)	52.10	35.20
BIRMINGHAM		
No. 2 Foundry	42.00@45.00	29.25
PHILADELPHIA		
Eastern Pa., No. 2x, 2.25-2.75 sil.	51.25	29.00–30.00
Virginia No. 2	50.00*	33.10
Basic	51.00†	26.75
Grey Forge	48.00*	26.75
CHICAGO		
No. 2 Foundry local	47.00	26.75
No. 2 Foundry, Southern	48.67	28.00
PITTSBURGH, INCLUDING FREIGHT CHARGE FROM VALLEY		
No. 2 Foundry	49.56	28.15
Basic	48.96	27.15
Bessemer	51.96	29.35

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$4.15	$4.30	$3.47	$3.44	$3.37	$3.58	$3.47
Soft steel bars	4.15	4.50	3.37	3.84	3.27	3.48	3.37
Soft steel bar shapes	4.15	4.50	3.37	3.84	3.27	3.48	3.37
Soft steel bands	5.50	6.43	4.07	6.25			
Plates, ¼ to 1 in. thick	4.15	4.75	3.67	3.64	3.57	3.78	3.67

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, Pittsburgh	$4.25	$2.77
Warehouse, New York	4.75	3.37
Warehouse, Cleveland	3.52	3.27
Warehouse, Chicago	4.12	3.37

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

	Large Mill Lots	New York			
Blue Annealed	Pittsburgh	Current	One Year Ago	Cleveland	Chicago
No. 10	3.55–3.00	6.15@8.00	4.57	6.75	6.13
No. 12	3.60–3.05	6.20@8.05	4.62	6.80	6.18
No. 14	3.65–3.10	6.25@8.10	4.67	7.35	6.23
No. 16	3.75–3.20	6.35@8.20	4.77	7.45	6.33
Black					
Nos. 18 and 20	4.20–6.20	7.90@9.80	5.30	8.30	6.90
Nos. 22 and 24	4.25–6.25	7.95@9.85	5.35	8.35	6.95
No. 26	4.30–6.30	8.50@9.90	5.40	8.40	7.00
No. 28	4.35–6.35	8.10@10.00	5.50	8.50	7.10
Galvanized					
No. 10	4.70–7.00	8.65@11.00	5.75	8.50	7.75
No. 12	4.80–7.10	8.75@11.00	5.85	8.60	7.80
No. 14	4.80–7.10	8.75@11.10	5.85	8.60	7.95
Nos. 18 and 20	5.10–7.40	9.00@11.40	6.15	8.90	8.25
Nos. 22 and 24	5.25–7.55	9.15@11.55	6.30	9.05	8.65
No. 26	5.40–7.70	9.30@11.70	6.45	9.20	8.80
No. 28	5.70–8.00	9.60@12.00	6.75	9.50	9.10

Acute scarcity in sheets, particularly black, galvanized and No. 16 blue enameled.

Automobile sheets are unavailable except in fugitive instances, when prices are 9.45c per lb. for No. 16; 9.50 for Nos. 18 and 20, and 9.55c for Nos. 22 and 24.

COLD FINISHED STEEL—Warehouse prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb. base	$6.15	$5.90	$5.50
Flats, square and hexagons, per 100 lb. base	6.65	6.40	6.00

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent.
New York	50
Cleveland	50
Chicago	50

NICKEL AND MONEL METAL—Base prices in cents per pound F.O.B. Bayonne, N. J.

Nickel	
Ingot and shot	43
Electrolytic	45

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55
Special Nickel and Alloys			
Malleable nickel ingots			45
Malleable nickel sheet bars			47
Hot rolled rods, Grades "A" and "C" (base)			60
Cold drawn rods, grades "A" and "C" (base)			72
Copper nickel ingots			42
Hot rolled copper nickel rods (base)			52
Manganese nickel hot rolled (base) rods "D" — low manganese			64
Manganese nickel hot rolled (base) rods "D"— high manganese			67

Domestic Welding Material (Swedish Analysis)—Welding wire in 100-lb lots sells as follows, f. o. b. New York: $\frac{1}{16}$, 8½c. per lb.; ⅛, 8c.; $\frac{5}{32}$ to ¼, 7½c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	7.00	8.00	9.15
Spring steel (light)	10.00	11.00	12.25
Coppered bessemer rods	9.00	8.00	6.85
Hoop steel	6.00	5.79	5.43
Cold-rolled strip steel	12.50	8.25	11.00
Floor plates	3.40	4.00	6.88

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card:

BUTT WELD

Steel			Iron		
Inches	Black	Galvanized	Inches	Black	Galvanized
⅛ to 3	54–57½%	41½–44%	⅛	15½–25½%	+1½–11½%
			¼	19½–29½%	1½–11½%
			⅜ to 1½	24½–34½%	8–18½%

LAP WELD

2	47–50½%	34½–38%	1¼		
2½ to 6	50–53½%	37½–41%	1½		
7 to 12	47–50½%	33½–37%	2	20½–28½%	6½–14½%
13 to 14	37½–41%		2½ to 6	22½–30½%	9½–17½%
15	35–38½%		7 to 12	19½–27½%	6½–14½%

BUTT WELD, EXTRA STRONG PLAIN ENDS

¼ to 1½	52–55½%	39½–43%	¼ to 1½	24½–34½%	9½–19½%
2 to 3	53–56½%	40½–44%			

LAP WELD, EXTRA STRONG PLAIN ENDS

2	45–48½%	33½–37%	1¼		
2½ to 4	48–51½%	36½–40%	1½		
4½ to 6	47–50½%	35½–39%	2	21½–29½%	8½–16½%
7 to 8	43–46½%	29½–33%	2½ to 4	23½–31½%	11½–19½%
9 to 12	38–41½%	24½–28%	4½ to 6	22½–30½%	10½–18½%
			7 to 8	14½–22½%	2½–10½%
			9 to 12	9½–17½%	5½–+2½%

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
⅛ to 3 in. steel butt welded	38%	22%	39%	30%	54%40%	40%@30%
2½ to 6 in. steel lap welded	33%	18%	41%	26%	50@40%	37½@27½%

Malleable fittings. Classes B and C, banded, from New York stock sell at plus 45%. Cast iron, standard sizes, plus 5%.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

	Current	Month Ago	Year Ago
Copper, electrolytic	14.75@15.00	18.50	22.50
Tin in 5-ton lots	37.00	44.50	56.50
Lead	7.00@7.25	8.50	6.25
Zinc	7.00	8.50	7.60
ST. LOUIS			
Lead	6.80@7.05	8.00	6.00
Zinc	6.60	7.70@8.05	7.15

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

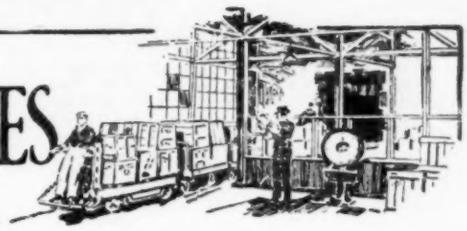
	New York			Cleveland		Chicago	
	Current	Month Ago	Year Ago	Current	Year Ago	Current	Year Ago
Copper sheets, base	24.50	29.50	33.50	26.50@29.00	35.50	36.00	36.50
Copper wire (carload lots)	31.25	31.25	30.75	24.00	30.50	29.00	26.00
Brass sheets	28.50	28.50	32.00	25.00	33.00	27.00	28.00
Brass pipe	28.00	33.00	36.00	30.00	39.00	34.00	37.00
Solder (half and half) (case lots)	31.00	35.00	45.00	29.00	41.00	38.00	38.50

Copper sheets quoted above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill, 100 lb. and over, warehouse; net extra:

	Current	One Year Ago
Mill	25.00	24.00
New York	27.00	28.00@29.75
Cleveland	25.00	29.00
Chicago	30.00	27.00

SHOP MATERIALS AND SUPPLIES



ZINC SHEETS—The following prices in cents per pound are f.o.b. mill—ess 8% for carload lots 11.50

	Warehouse			
	—In Casks—		— Broken Lots —	
	Current	One Year Ago	Current	One Year Ago
Cleveland	15.30	12.50	14.70	13.00
New York	14.00	11.50	14.50	12.50
Chicago	14.50	16.50	14.95	16.00

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current	One Year Ago
New York	7.25	9.50
Chicago	7.50	9.75
Cleveland	8.50	9.75

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	— New York —			
	Current	One Year Ago	Cleveland	Chicago
Copper, heavy, and crucible	12.50	17.00	12.00	12.50
Copper, heavy, and wire	12.00	16.00	11.75	11.50
Copper, light, and bottoms	10.00	14.00	10.00	10.00
Lead, heavy	5.50	4.75	5.50	5.50
Lead, tea	4.50	3.75	3.75	4.50
Brass, heavy	7.00	10.50	8.00	11.50
Brass, light	5.50	7.50	5.00	6.00
No. 1 yellow brass turnings	7.00	10.00	6.00	6.00
Zinc	4.50	5.00	3.75	5.00

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	$33.00	$30.00	$33.50

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York (round)	38.00	32.00
Chicago	29.00	31.00
Cleveland	27.00	35.00

BABBITT METAL—Warehouse price per pound:

	—New York—		—Cleveland—		— Chicago —	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	80.00	90.00	49.00	70.00	45.00	60.00
Commercial	40.00	50.00	19.50	16.50	11.00	13.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York we quote the best two grades, although lower grades may be obtained at from $16 to $20.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	— New York —		— Cleveland —		— Chicago —	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	+$1.25	$1.50	List net	$2.25	+1.15	1.85
Hot pressed hexagon	+ 1.25	1.50	List net	2.25	+1.15	1.85
Cold punched hexagon	+ 1.25	1.50	List net	2.25	+1.15	1.30
Cold punched square	+ 1.25	1.50	List net	2.25	+1.15	1.30

Semi-finished nuts, ⅞ and smaller, sell at the following discounts from list price:

	Current	One Year Ago
New York	30%	50-10%
Chicago	40%	50%
Cleveland	50%	60-10%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	+10%	25%	30%
Larger and longer up to 1½ in. by 30 in.	Net list	25%	20%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... list Cleveland..... $2.50 Chicago..... $1.90

For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:
New York..... $7.00 Cleveland..... $4.50 Chicago..... $5.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	+20%	25%	20%
Larger and longer up to 1 in. by 30 in.	+20%	20%	15%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	20%	20%	10%	10%
Chicago	net	20%	net	20%
New York	30%	40%	net	20%

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	20%	40%	30%
Tinned	20%	40%	30%

Boiler, ¾, ⅞, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York..... $6.00 Chicago..... $5.73 Pittsburgh..... $4.5

Structural, same sizes:
New York..... $7.10 Chicago..... $5.83 Pittsburgh..... $4.60

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	28.00	33.00	35.00
Brass	27.00	30.00	34.00

The prices, of course, vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1 c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities from 10-25 lb., extra is 10c.; less than 10 lb., add 15-20c.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in. inclusive in rounds, and ⅛-1½ in., inclusive, in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $1.50.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $10.85 per 100 lbs.

In Cleveland—$10 per 100 lbs.

COTTON WASTE—The following prices are in cents per pound:

	— New York —			
	Current	One Year Ago	Cleveland	Chicago
White	15.00@17.00	13.00	16.00	15.00@17.90
Colored mixed	9.00@14.00	9.00-12.00	12.00	11.00@13.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½x13½	13½x20½
Cleveland	55.00	65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$2.00	$2.00	$1.75
Philadelphia	2.75	2.75	1.75
Cleveland	3.00	3.00	2.50
Chicago	2.00	2.75	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$3.50	$3.90	$3.65
Philadelphia	3.65	3.65	3.87
Chicago	4.10	5.00	4.12½

COKE—The following are prices per net ton at ovens, Connellsville:

	November 15	November 8	November 1
Prompt furnace	$11.50@$12.00	$16.00@$16.50	$16.00@$16.50
Prompt foundry	12.50@13.00	17.00@18.50	17.00@18.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	100-lb. bag	1.00

LINSEED OIL—These prices are per gallon:

	—New York—		—Cleveland—		—Chicago—	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Raw in barrels, (5 bbl. lots)	$1.02	$2.15	$1.25	$2.50	$1.17	$2.37
5-gal cans	1.17	2.30	1.50	2.75	1.42	2.57
1-gal cans (6 to case)	1.27	....	....	....	....	

WHITE AND RED LEAD—Base price per pound:

	Red				White			
	Current		One Year Ago		Current		One Year Ago	
	Dry	In Oil	Dry	In Oil	Dry and In Oil		Dry and In Oil	
100 lb. keg	15.50	17.00	13.00	14.50	15.50	13.00		
25 and 50-lb. kegs	15.75	17.25	13.25	14.75	15.75	13.25		
12½-lb. keg	16.00	17.50	13.50	15.00	16.00	13.50		
5-lb. cans	18.50	20.00	15.00	16.50	18.50	15.00		
1-lb. cans	20.50	22.00	16.00	17.50	20.50	16.00		

500 lb. lots less 1% discount. 2000 lb. lots less 10-20½% discount.

(Continued from p. 972e)

N. Y., New York (Borough of Bronx)—J. E. Sheehey, 256 Bway., New York City, will build a 1 story, 100 x 100 ft. garage on Southern Blvd. and 172d St. Estimated cost, $40,000.

N. Y., New York (Borough of Brooklyn)—J. J. Burke, c/o T. Bennett, Archt., 7826 5th Ave., will build a 1 story, 140 x 165 ft. garage on Montgomery Pl. Estimated cost, $35,000.

N. Y., New York (Borough of Brooklyn)—The Grant Improvement Co., c/o Tobias & Goldstone, Archts. and Engrs., 50 Graham Ave., will build a 1 story, 75 x 100 ft. garage at 876 De Kalb Ave. Estimated cost, $30,000.

N. Y., New York (Borough of Brooklyn)—The Hyland Constr. Co., 215 Montague St., will build a 1 story, 30 x 180 ft. garage on Grand Ave. and Bergen St. Estimated cost, $35,000.

N. Y., New York (Borough of Manhattan)—The Vesey Holding Co., 160 Bway., will build a 4 story, 150 x 200 ft. garage at 254 West 54th St. Estimated cost, $100,000. R. B. Ittleson, Pres.

Pa., Philadelphia—J. Waldow and A. Samenfield, 707 Walnut St., are having plans prepared for the construction of a 2 story, 75 x 110 ft. garage on 21st and Berks Sts. Estimated cost, $20,000. E. A. Wilson, 1208 Chestnut St., Archt.

SOUTHERN STATES

Ky., Louisville—The Ewald Iron Co., 224 North Clay St., plans to build an addition to its plant. Estimated cost, $2,000,000.

Ky., Louisville—The Ford Motor Co., 2500 South 3d St., plans to build a 100 x 200 ft. addition to its plant. Estimated cost, $500,000.

MIDDLE WEST

Ill., Chicago—Felt & Tarrant Mfg. Co., 1717 North Paulina St., is having preliminary sketches made for a factory at 1700 North Paulina St., for the manufacture of adding machines. L. G. Hallberg, 116 South Michigan St., Archt.

Ill., Chicago—The G. W. Moore Co., 2144 Fulton St., has awarded the contract for the construction of a 1 story, 120 x 144 ft. machine shop at 2128-44 Fulton Ave. Estimated cost, $75,000.

Ill., Chicago—The Universal Machine & Tool Corp., 4146 West Taylor St., plans to build a 2 story, 58 x 265 ft. factory. Estimated cost, $100,000. A. A. Tocha, 1225 North Ashland Ave., Archt.

Ill., Rock Island—The Construction Div., War Dept., Wash., D. C., plans to build a recuperator shop at the arsenal here. Bids will be opened by the Construction Quartermaster, at the above post.

O., Cincinnati—The Williamson Heater Co., West 5th St., has awarded the contract for the construction of a 1 story, 60 x 120 ft. factory, for the manufacture of hot air furnaces. Estimated cost, $40,000.

O., Cleveland—A. Brennen, 2324 Denison Ave., has had plans prepared for the construction of a 1 story, 30 x 36 ft. machine shop. Estimated cost, $5,000. Private plans.

O., Cleveland—The Cleveland Coldrawn Steel Co., c/o W. W. Wallace, Natl. City Bldg., plans to build a 1 story, 160 x 400 ft. steel plant on Dunham Rd. Estimated cost, $250,000. Private plans.

O., Cleveland—The Felber Sales Co., 1836 Euclid Ave., has had plans prepared for the construction of a 1 story, 40 x 120 ft. garage and office building at 1535 East 38th St. Estimated cost, $25,000. Poe Engr. Co., Kirby Bldg., Engrs.

O., Cleveland—The Hayden Investment Co., Park Bldg., plans to construct a 5 story, 80 x 210 ft. commercial building and garage on East 30th St. and Prospect Ave. Estimated cost, $400,000. J. L. Weinberg, Schofield Bldg., Archt.

O., Clevland—The Upson Nut Co., 1980 Carter Rd., will build a 2 story, 24 x 52 ft. addition to its factory. Estimated cost, $15,000.

O., Columbus—W. E. Lamneck Co., West 5th Ave., will soon award the contract for the construction of a 1 story, 120 x 204 ft. factory for the manufacture of furnaces and ventilating apparatus. Estimated cost, $50,000. A. P. Lamneck, Secy. and Treas. Private plans.

O., Dayton—V. E. Herter Co., Meigs St., has awarded the contract for the construction of a 1 story, 54 x 80 ft. garage and repair shop. Estimated cost, $20,000.

Wis., Schleisingerville — The Zwebell Bros. Co., 428 Milwaukee St., Milwaukee, has awarded the contract for the construction of a 2 story, 60 x 100 ft. factory on Main St., for the manufacture of vulcanizing outfits. Estimated cost, $75,000. Noted Nov. 4.

Wis., Sheboygan—The South Side Garage Co., North 12th St. and Indiana Ave., has awarded the contract for the construction of a 2 story, 45 x 112 ft. garage on Indiana Ave. Estimated cost $75,000. Noted Nov. 4.

WEST OF THE MISSISSIPPI

Ark., Earle—The Grenada Cotton Compress Co. plans to build a 1 story cotton compress to replace the one which was destroyed by fire. Estimated cost, $100,000.

Mo., St. Louis—The Power Truck & Tractor Co., Beard and Goldsmith Sts., Detroit, Mich., plans to build an auto truck factory on Mead St. here, along the tracks of the Wabash R.R. Estimated cost, $250,000. Address B. B. Craven, Chemical Bldg., Owner's Agt.

Mo. St. Louis—The Southern Car Wheel Co., Ry. Exch. Bldg., plans to build a car wheel factory on Marcus Ave. along the tracks of the Terminal R.R. Estimated cost, $500,000.

Tex., Ranger—The Ranger Boiler Wks. plans to build a factory for the manufacture of fire escapes, steel stairways, etc. Estimated cost, $100,000. L. C. McFall, Pres.

General Manufacturing

Conn., Jewett City—The Fisk Rubber Co., Chicopee Falls, does not plan to build a factory here. This item erroneously reported in our issue of Oct. 28.

Conn., Norwalk—The St. George Pulp & Paper Co., 6 Smith St., has awarded the contract for the construction of a 1 story, 65 x 65 ft. addition to its manufacturing plant on Smith St. Estimated cost, $15,000.

Mass., Jamaica Plain (Boston P. O.)—E. Weiler, 3558 Washington St., has awarded the contract for the construction of a 1 and 2 story, 40 x 60 ft. milk plant, etc., on Washington St. Estimated cost, $15,000.

Mass., Worcester—Tait Bros., Cass St., Springfield, will build a 3 story, 60 x 120 ft. plant on Shrewsbury St., for the manufacture of ice cream. Estimated cost, $75,000. Noted Nov. 11.

R. I., Slocum—The Yawgoo Cotton Mills, Inc., has awarded the contract for repairing it's present mill. Estimated cost, $25,000.

MIDDLE ATLANTIC STATES

Md., Baltimore—The Baltimore Mfg. Co., manufacturers of chemicals, vinegar, yeast, etc., controlled by the Fleischmann Co., Perry and Plum Sts., Cincinnati, O., plans to construct additions to its 2 plants on Buren and Monument Sts., and Central Ave. and Bank St., here. Estimated cost, $1,000,000.

Md., Baltimore—The Metal Package Co., 346 Carroll St., Brooklyn, N. Y., has acquired the Boyle Can Co., Wolf and Thames Sts., here, and plans to enlarge same and install additional equipment.

N. J., Maurer—The Barber Asphalt Paving Co., Land Title Bldg., Philadelphia, Pa., is having plans prepared for the construction of a machinery building, manufacturing plant and power house. Estimated cost, $1,000,000. Lockwood Green & Co., 101 Park Ave., New York City, Archts. and Engrs.

N. J., Ridgefield—The Continental Folding Paper Box Co., 122 Washington St., Brooklyn, N. Y., will soon award the contract for the construction of a 2 story, 100 x 500 ft. factory on Grand Ave. and Hall St. W. B. Wills, Inc., 1181 Myrtle Ave., Brooklyn, N. Y., Archts. and Engrs.

N. Y., New York (Borough of Brooklyn)—J. Santinima, 62d St. and 17th Ave., manufacturer of artificial stones, will construct a 1 story, 20 x 60 ft. storage building, 1 story, 35 x 40 ft. factory and two 1 story 15 x 40 ft. sheds. Estimated cost, $85,000.

Pa., Great Bend—The N. H. Parke Leather Co. is having plans prepared for the construction of a 3 story, 75 x 200 ft. tannery. Estimated cost, $150,000. Lockwood Green & Co., 101 Park Ave., New York City, Archts. and Engrs.

Pa., Johnstown—The Johnstown Sanitary Dairy Co. will soon award the contract for the construction of a 3 story ice cream factory on Somerset St. Estimated cost, between $50,000 and $60,000. McCormick Co., Century Bldg., Pittsburgh, Engs. Noted Oct. 14.

Pa., Philadelphia—The Belmont Packing & Rubber Co., 133 North 2nd St., has awarded the contract for the construction of a 2 story, 130 x 190 ft. addition to its plant on Coal and Wheatsheaf Sts. Estimated cost, $60,000.

Pa., Philadelphia—L. Rosenau Co., Darien and Noble Sts., has awarded the contract for the construction of a 2 story, 65 x 130 ft. factory at 464 North 8th St., for the manufacture of braid. Estimated cost, $45,000.

SOUTHERN STATES

Ky., Louisville—The Ten Broeck Tire Co., 840 South 26th St., plans to build an addition to its tire factory on 26th and Courtney Sts. Estimated cost, $1,000,000.

MIDDLE WEST

Ill., Chicago—J. Klicha, West 20th St. and South California Ave., has awarded the contract for the construction of a 1 story, 85 x 125 ft. furniture factory, etc. Estimated cost, $100,000.

Mich., Detroit—The Consolidated Cigar Co., St. Aubin Ave., has awarded the contract for the construction of a 3 story, 92 x 100 ft. cigar factory. Estimated cost, $90,000. A. Kahn, Marquette Bldg., Archt. Noted Sept. 30.

Mich., Detroit—The Detroit Packing Co., 40 Bushey St., is having preliminary plans prepared for the construction of a [illegible] story packing plant on Springwells Ave. (to be the first of 2 units). Estimated cost, $1,000,000. Packers Architectural & Eng. Co., Manhattan Bldg., Chicago, Archts. and Engrs.

O., Cleveland—F. H. Kole, 11006 Lorain Ave., painter, has awarded the contract for the construction of a 1 story, 24 x 42 ft. factory. Estimated cost, $10,000.

O., Cleveland—The Mazzilini Artcraft Co., c/o J. Mazzilini, 4424 Payne Ave., has awarded the contract for the construction of a 2 story, 34 x 60 ft. factory on East 67th St. and Clair Ave. Estimated cost, $25,000. Noted Nov 11.

O., Sandusky—The Mathews Engr. Co., Monroe and King Sts., has awarded the contract for the construction of a 1 story, 100 x 150 ft. factory. Estimated cost, $75,000.

Wis., Delavan—The Delavan Dairy Co. has awarded the contract for the construction of a 2 story, 40 x 160 ft. milk condensory. Estimated cost, $75,000.

Wis., Racine—The Grant Furniture Co., 502 6th St., had plans prepared for the construction of a 3 story, 80 x 120 ft. factory on Washington Ave. and Center St. Estimated cost, $60,000. S. Grant, Prop.

Wis., Rice Lake—Badertscher Bros., R. F. D. No. 3, plan to build a cheese factory. Estimated cost, $20,000.

WESTERN STATES

Wash., Seattle—A. M. Castle Co., 1201 1st St., S., will soon award the contract for the construction of a 2 story, 160 x 750 ft. warehouse on East Marginal Way and Alaska St. J. H. Nevins, Hoge Bldg., Archt.

CANADA

N. F., Bonne Bay—The St. Lawrence Timber, Pulp & Steamship Co. Ltd. plans to build a plant here, to include a sulphite mill.

Que., Macamic—The Macamic Nord Ltd. will soon receive bids for the construction of a saw mill. Estimated cost, $32,000.

FOREIGN

S. A., Peru, Lima—A. Grana will soon receive bids for the construction of a cotton mill, here, containing 6,000 spindles. Estimated cost, $500,000. Lockwood Green & Co., 101 Park Ave., New York City, Archts. and Engrs.